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CONTRIBUTIONS TO OUR KNOWLEDGE OF AMERICAN CARBONIFEROUS FLORAS[1]

IV. A New Species of Lepidodendron

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Previous investigations have established *Lepidodendron* as one of the most abundant and widely distributed genera during the Carboniferous period, and the results of the present study indicate that it was the dominant element of the southern Illinois flora in middle Pennsylvanian times.

Lycopod remains are present in almost every specimen of the hundreds of coal-balls collected during the past two years from the Pyramid mine of the Binkley Coal Company in Perry County, Illinois.[2] Over 100 stems referable to *Lepidodendron* have been found thus far. This study is based chiefly on a selection of about 25 of the best-preserved specimens exhibiting a representative picture of the structural variations found in the various orders of branching. Associated with the stems are leaves, roots, and reproductive organs. Some of these have already been described (Andrews and Pannell, '42) while others will be considered here and in later studies.

Lepidodendron scleroticum sp. nov.

The designation of a new species of this supposedly well-known genus probably needs a few words of explanation. Since Sternberg's

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[2] A detailed description of the occurrence of coal-balls at this locality has been given in the first of this series of contributions (Ann. Mo. Bot. Gard. **29**: 1–18. 1942).

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account of the type species in 1823, more than 100 others have been described from compression material and over 20 from petrified specimens. There is little doubt that a considerable amount of synonymy exists in this long list of names. It is equally obvious to any investigator who has studied the Carboniferous Lycopods at all carefully that we are only beginning to understand the morphological boundaries of the group. Very notable contributions relative to their reproductive organs have been made during the past few years (Arnold, '40; Hoskins and Cross, '41; Schopf, '38; Andrews and Pannell, '42). It is hoped that future studies will shed more light on the relationships between the cones and isolated vegetative remains.

Lepidodendron stems constitute the dominant element of our Pyramid Mine collections, and the genus is abundantly represented in the roof shales of certain southern Illinois mines. The large number of specimens at hand makes possible a much more complete description of the stem structure of the plant as a whole than do most of the previously described species, many of which are based on a single specimen. It will also be shown that *L. scleroticum* presents highly distinctive cortical characters which in themselves adequately justify the new specific name.

The stems range from 3 mm. to 9 cm. in diameter, while larger stelar fragments or portions of bark were found indicating stems as large as 30 cm. in diameter. Two specimens with abundant secondary growth have been selected to show the typical organization of the tissues and the distinctive features of the species (pl. 18, figs. 1 and 2). They are numbers WCB55 and WCB56 respectively, in the Washington University fossil plant collection. A description of these specimens is followed by a shorter consideration of certain others in order to present a composite picture of the shoot system as a whole.

The pith, which is present in all of the larger stems, is surrounded by the xylem cylinder of primary and secondary origin, which is in turn surrounded by the phloem. The cortex may be divided into three zones, although these are not always distinct. The inner cortex immediately exterior to the phloem is composed of delicate parenchymatous and small sclerotic cells. The parenchyma cells are often poorly preserved and the sclerotic cells crushed. The highly distinctive middle cortex consists of sclereids grouped into nests and surrounded by parenchyma. The outer cortex presents a dicty-

oxylon arrangement of slightly elongate thickened cells and parenchyma.

The periderm forms a large portion of the stem. It is composed of compactly arranged cells that were intimately connected with the mechanical support of the tree. The cork cambium is well preserved in some of the smaller stems.

Development of the Primary Xylem.—

In *Lepidodendron scleroticum* there is a marked relationship between stem size and primary xylem development. In small twigs from 3 to 10 mm. in over-all diameter, the xylem cylinder is typically protostelic, measuring from .26 to .78 mm. (pl. 19, fig. 6). The protoxylem is exarch and unevenly distributed around the periphery. Branches with steles as small as this never exhibit any secondary xylem. Stems from 10 to 22 mm. show a mixed protostele varying from 1.04 to 1.56 mm. in diameter (pl. 19, fig. 3). When the cylinder of the primary xylem attains a diameter of 1.5–2 mm. secondary wood begins to form. In older stems from 3 to 5 cm. in diameter the

TABLE I

SHOWING THE RELATIONSHIPS BETWEEN DIMENSIONS OF PITH AND PRIMARY AND SECONDARY XYLEM IN THE VARIOUS BRANCH ORDERS

Stem No.	Total diameter of stele	Radius of the primary body	Radius of the primary xylem (X_1)	Radius of the secondary xylem (X_2)
	mm.	mm.	mm.	mm.
WCB16 (2)	.26	.13	.13	None
WCB55A (2)	.39	.18	.18	None
WCB54 (2)	.45	.23	.20	None
WCB265 (2)	.52	.26	.24	None
WCB16B (3)	.52	.26	.24	None
WCB54 (3)	1.04	.53	.31	None
WCB55A (2)	1.10	.55	.45	None
WCB124A (1)	1.30	.65	.55	None
WCB54C (7)	1.56	.78	.52	None
WCB16B (3)	1.69	.64	.58	None
WCB54A (8)	1.69	.84	.71	X_2 beginning
WCB58A (2)	1.88	.94	.78	X_2 beginning
WCB106A (1)	2.08	1.04	.80	None
WCB124A (1)	2.08	.84	.62	.19
WCB19C (1)	4.81	1.23	.65	1.17
WCB135A (2)	5.20	1.69	.91	1.04
WCB180A (2)	5.72	1.30	.84	1.56
WCB57A (2)	5.98	1.69	.91	1.43
WCB56B (7)	6.24	1.82	.97	1.30
WCB148A (2)	6.76	1.82	1.04	1.52
WCB55A (10)	6.86	1.56	1.04	1.82
WCB61B (1)	7.80	1.82	1.77	2.08
WCB18A (2)	7.87	1.95	1.77	2.21
WCB20X (5)	8.12	2.04	1.04	2.20

xylem cylinder averages 6.7 mm., of which 3.1 is primary and 3.6 is secondary. The pith is now well developed, forming about one-half the total diameter of the primary body. Figure 6 is a photograph of the largest stele found, the secondary xylem measuring 22 mm. in radius and the primary xylem 6–7 mm. Table 1 presents a more detailed compliation of the dimensions of 24 well-preserved stems.

The sequence of development shown in the table is uniform, and since only stems with well-preserved cortical tissues were used there is no reason to believe that they are not all referable to *L. scleroticum.*

A study of this series not only clearly illustrates the intra-stelar origin of the pith, but it presents evidence that the whole primary body increases in size even after the initiation of secondary wood. The evidence is based on the three following points: (1) no secondary wood around a protostele or a small primary cylinder was observed; (2) all the larger stems showed a siphonostele which probably developed from the smaller mixed protostele during the formation of the first few mm. of secondary growth; (3) wedge-shaped gaps exist between the secondary tracheids along the contact zone between the primary and secondary xylem (fig. 8) which are constant in all stems of any appreciable secondary growth. The gaps may be due either to pressure exerted by the increased circumference of the primary cylinder or to the decay of parenchymatous tissue laid down during the early stages of cambial activity. The rather fine preservation of the immediately adjoining parenchyma cells in both primary and secondary wood leaves little doubt that the first explanation is the correct one. The increase in size of the metaxylem was probably accomplished both by the maturation of the individual tracheids (cf. figs. 3, 6) as well as by the division of parenchyma cells associated with the tracheids.

Bower ('30) has been the most active investigator of the development of the primary body of vascular cryptogams. His research attempted to determine the physiological relationships between tracheids and living parenchyma cells which seemingly govern the ontogeny of the primary stelar body. He dealt largely with the different types of steles exhibited in the various species of Lycopods and concluded that the primitive xylic column in the fossil forms may undergo one or more of four types of progressive changes in order to maintain a more or less constant tracheid-parenchyma relationship. These may be briefly summarized as:

1. A "fluting" of the periphery of the primary body is noted in certain species (*L. Harcourtii* Witham, and *L. selaginoides* Binney). This fluting resulted in a series of concave crenulations which increased the surface area.

2. Medullation occurs in most Lepidodendrons, but some are reported as protostelic while others develop a mixed protostele or siphonostele. Bower described branches of *Lepidophloios Wunschianus* Carruthers which show a general relationship of stem size to pith development, but he made no observations on the beginning of secondary growth in the various twigs.

3. In species which developed secondary xylem the wood rays apparently served to retain a more or less constant tracheid-parenchyma relationship. Secondary wood may occur in both protostelic and medullated species although in some it is reported as absent.

4. Segregation of the primary xylem into separate strands occurs in certain *Lepidostrobus* cones (*L. Brownii*).

These four tendencies apparently helped maintain a nearly constant ratio of living to dead cells in the progressive evolution of the vascular tissue in the fossil Lycopods.

The Secondary Xylem.—

The fossil Lycopods produced little secondary wood in comparison with the size of the trunk. In most of the *Lepidodendron scleroticum* stems studied, which were about 4 cm. in diameter, the ring of secondary xylem measured from 1 to 2 mm. in width. Isolated fragments in which the secondary wood reached a radial dimension of 5 cm. were found, but it cannot be said definitely that they belong to *L. scleroticum,* since the outer parts of the stem were not preserved. However, the specimen previously discussed (pl. 19, fig. 4), which developed secondary wood 3 cm. in thickness, possessed enough fragments of the characteristic cortical sclerotic nests to be assigned to this species.

At first, secondary growth is slight and develops frequently only on one side, with gaps between the active cambial cells. In such specimens the cambial development is closely comparable to that found in *Lepidodendron fuliginosum* Williamson, *L. intermedium* Williamson, and *L. obovatum* Sternberg. This peculiar type of cambial activity is described by Scott ('20, p. 137), for the above three species as follows:

"The cambium was an anomalous one, arising in various parts of the phloem zone and pericycle. It produced a good deal of the secondary parenchyma, among which there are usually scattered groups of wood; the secondary tracheids have a very sinuous and irregular course. We may regard these species as exhibiting either a primitive and rudimentary or reduced form of secondary wood."

Lepidodendron scleroticum shows this supposed primitive character only at the beginning of the growth of secondary wood, for after 10 to 20 xylem cells have been formed in an irregular manner the tracheids around the entire primary stele develop actively. There is frequently unequal growth of secondary wood on one side of the cylinder, probably due to some environmental condition.

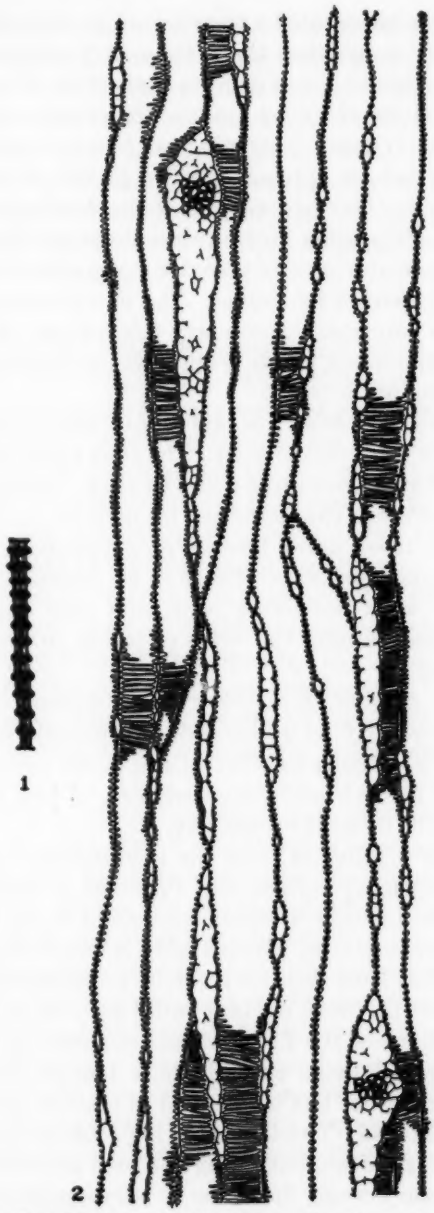
The first few secondary tracheids formed average 52 μ in width; but after 10 to 20 cells have developed, the tracheids range from 88 to 104 μ. None of the secondary tracheids reached the robust size of the primary ones which average 130 μ, some even 195 μ. Although the length of the tracheids is difficult to follow, due to their frequent distortion by rays and traces, approximately 30 cells were followed in their entirety. These were found to average 12 mm., some reaching 15 mm. Near the ends, the tracheids gradually tapered to a point.

Using the maceration technique, the pronounced scalariform sculpturing of the secondary walls of the primary and secondary tracheids was studied in detail (fig. 5). The transverse bars are about 5.3 μ in width and are spaced at a slightly greater distance. They extend completely across the wall face and at the corners merge into a continuous layer. The bars frequently dichotomize but with no regularity. Extending across the openings between the bars is a series of numerous fine threads which have been described in several other species of *Lepidodendron* as well as in *Lepidostrobus Bertrandi* Zalesky, *Sigillaria Boblayi* Brongn. and *Stigmaria ficoides* Brongn. Three interpretations of their morphology have been recorded:

1. Seward and Hill ('00) describe them as post-mortem changes in the primary wall which made the pit-closing membrane torn and fragmentary.

2. Calder ('32) considers them, in *Lepidodendron Brownii* Unger, as tertiary thickenings laid down in a thin layer around the bars of the scalariform thickenings, with the fine threads connecting the layers.

3. Arnold ('40), in his description of *Lepidodendron Johnsonii*, regards them as part of the secondary thickenings which lay against the primary wall and bridged the pit cavity on the inside.



Text-figs. 1–2.—*Lepidodendron scleroticum:* fig. 1, longitudinal section of scalariform thickenings, × 100; fig. 2, tangential section of wood, × 50.

A study of the macerated tracheids of *L. scleroticum* presents strong evidence supporting their secondary nature as described by Arnold. The threads show definite connection with the secondary thickenings (text-fig. 1). They are also too evenly spaced to be torn fragments of the primary thickenings as Seward and Hill regarded them. Their structure appears similar to the outgrowths of the secondary walls in the vestured pits of the Angiosperms described by Bailey ('33). The scalariform thickenings and the threads seem to be of the same material with no outer layer of the bars or tertiary thickenings as reported by Calder. The fine strands are, as far as it is possible to determine, secondary thickenings of the same material as the scalariform bands lying next to the primary wall connecting adjoining bars.

The wood rays vary from a single row of cells to many cells high and several cells wide (text-fig. 2). The cells range from 15 to 30 μ in diameter and are about three times as long (radially). The walls of all the ray cells are characterized by delicate scalariform thickenings although these never become as pronounced as in the tracheids or leaf trace elements. There is no reason to believe, however, that they were not living cells, and they present the only possibility of maintaining the ratio of living to dead cells in the secondary xylem.

On the basis of studies in other plant groups the rays of *L. scleroticum* are clearly of an exceedingly primitive nature. This is suggested both in the variability in size of the rays as a whole, as well as the wide range in individual cell size. A less specialized ray structure would be difficult to conceive.

The leaf trace originated from the protoxylem cells at the periphery of the primary xylem and followed a horizontal course through the entire extent of secondary wood in all the specimens studied. This feature is of considerable interest since the largest stems had certainly shed their leaves before any appreciable amount of secondary growth. Both the tangential sections of the leaf bases and the impressions of the *Lepidodendron* stems in the shale indicate that only small twigs actually bore leaves. This persistent growth of the leaf trace has been noted in certain species of *Araucaria,* living and fossil. The character is probably present in other species of *Lepidodendron,* but it has not been studied in detail.

Near the primary wood the trace is surrounded by only a few ray cells, but as it progressed through the secondary wood the surrounding ray tissue increased in height and breadth. Text-fig. 2

was drawn from a tangential peel taken about 3 mm. from the periphery of the primary wood. The amount of xylem cells remains relatively constant in all the traces, as well as within the same trace as it progresses through the secondary wood. The protoxylem, if such were differentiated, is not distinguishable.

The leaf trace follows an upward course through the cortex and then resumes a horizontal course through the extensive periderm tissue. This will be considered in more detail in the discussion of the extra-stelar tissues.

Branching.—

An excellent specimen showing monopodial branching is included in our collections (No. WCB254). The block was sectioned into nine parts and the stele studied at the various stages of development. The progressive origin and departure of the branch trace, with the closing of the gap, are illustrated in pl. 21, figs. 13–16. In fig. 13 the stele is seen before the departure of the branch, while fig. 14, which is 5 mm. above, represents the beginning of the trace. In fig. 15 the branch trace has progressed in its upward course 10 mm., and in fig. 16 about 20 mm., from the point of origin. The new stele is at first crescent-shaped, and as it departs, some secondary wood is carried with the primary tracheids (fig. 15). The branch gap is then bridged and the stele of the branch becomes circular, losing the secondary wood. Shortly above the last stage figured, the specimen becomes poorly preserved and the newly formed branch is completely lost.

In fig. 16 at *p* a band of tissue, secondary in origin and presumably periderm, may be noted. In all probability this represents the junction of the stem and branch cork but it was not possible to follow it up high enough to observe the actual separation of the branch.

Most of the stem compressions observed in the roof shales in southern Illinois mines indicate that dichotomy was of more frequent occurrence than monopodial branching, and only a few poorly preserved specimens branching dichotomously have been found in the coal-balls. Although a reconstruction of *L. scleroticum* probably compares closer to Hirmer's for *L. obovatum* (Hirmer, '27) than it does to Scott's for *L. elegans* (Scott, '20) the types of branching undoubtedly varied considerably in different species.

Cambium and Phloem.—

The delicate nature of the cambium and phloem prevents good preservation in fossil plants. In *L. scleroticum,* these tissues are

partially preserved only in the better specimens. The cambium appears to have been composed of several layers of cells, and the surrounding phloem area is very small when compared with the large amount of secondary wood. These cells are represented in fig. 11. There have been two interpretations of the structure of the phloem cells in *Lepidodendron*: one, supported by Weiss ('01), states that sieve cells are present; the other view, that of Seward ('02), holds that the phloem cells were not morphologically sieve cells but a type of secretory cell. It is only possible to say that the phloem in *L. scleroticum* probably consisted of very primitive undifferentiated parenchymatous cells not great in extent and little of secondary origin.

The Cortex.—

The cortical tissue is composed of three zones which are distinct even in young twigs. The inner cortex directly adjoining the phloem consists of delicate parenchymatous cells and small heavily thickened sclerotic cells. The parenchymatous cells are usually poorly preserved and the sclerotic cells crushed. The disorganized tissue forms a band next to the xylem in most of the stems (fig. 21).

The remaining cortical cells, separated from the inner cortex by a cavity caused by the decay of that tissue, are well preserved. The middle cortex is composed of heavily thickened sclerotic cells grouped into nests and surrounded by parenchymatous cells most abundantly associated with the leaf traces which follow a gradual upward course through the cortex. The position, arrangement, and size of these cells may be noted in figs. 17, 18, and 19.

The outer cortex consists of parenchymatous and sclerenchymatous cells which are less thickened and more elongated than the sclerotic ones of the middle cortex. At first there are only a few small elongate sclerenchymatous cells among the sclerotic nests, but in the outer portions of the cortical region a reticulate network is formed from the decayed parenchymatous cells surrounding the leaf trace and the fibrous sclerenchyma (fig. 20).

The composition and arrangement of the cortical tissue present the most distinctive characters of *Lepidodendron scleroticum*. The sclerotic nests, which have never been reported in a species of *Lepidodendron*, make possible specific recognition when only fragments of the stems are preserved. The reticulate network of the outer portions of the cortex has been described in *L. esnostense* and *L. rhodumnense* Renault ('79). These species differ from *L. sclerot-*

icum not only in cortical tissue, for they have no sclerotic nests, but they were protostelic with no secondary xylem.

The Periderm.—

The periderm of the fossil Lycopods is one of their most characteristic features, since it was not primarily a protective tissue, but served as the main support of the stem. The early English paleobotanists regarded it as vascular tissue or "pseudo-wood" (Binney, 1862, Witham, 1833). Williamson (1872) was the first investigator to dispel this erroneous concept. Since that date our knowledge of this tissue has rapidly increased, terminating in the thorough study by Kisch ('13).

In *Lepidodendron scleroticum,* the cork cambium arises early in the growth of the twig, often before the mixed stele has developed an active vascular cambium. The phellogen originates 5–10 cells within the epidermis and divides rapidly. As in other species of *Lepidodendron,* the division is the exact reverse of the phellogen activity in modern trees, for the cambium lays down the great bulk of the tissue centripetally with only a small portion of phellem. A young twig shows little cellular differentiation of the cork (fig. 23) until after 2 to 3 mm. of growth. Its cells near the leaf bases divide radially, which increases the circumference of the stem and keeps the leaf bases intact. Most of the periderm cells are 6–10 times longer than broad and are sharply pointed at the ends. They vary from thick and heavy to fragmentary and thin (fig. 22). The transition occurs in frequent succession and the partial decay of the thin-walled cells produces a series of holes. Such a periderm structure has been described in *Lepidodendron selaginoides* and *Lepidophloios Wunschianus,* but the degree of thickening of the preserved cell walls in those species is more constant. These gaps in the periderm have been described by Hovelacque ('92), in *Lepidodendron selaginoides,* as less-resistant layers formed at periods of sluggish growth, but recently they have been interpreted in another species as secretory strands (Arnold, '40). Although some of the cells surrounding the cavities show horizontal septa in tangential section, there are no other indications that the gaps were anything but decayed cells of less-resistant structure.

The leaf trace follows a horizontal course through the great mass of periderm. Small sclerotic cells of the cortex may follow the trace for a distance into the cork, but the parenchyma cells associated with the trace have greatly decreased in mass.

The Leaf Bases.—

The structurally preserved leaf bases of *L. scleroticum* were studied by peels made tangential to both young and old stems and were found to have the characteristic shape shown in fig. 26. The general appearance of the leaf cushions is a spiral arrangement of rhomboid structures separated by a narrow groove where the stem surface was exposed. A small ligule, sunken in a pit, appears near the apex of the cushion. Beneath the ligule is the vascular bundle surrounded by a cavity of decayed parenchyma and phloem. In most species, parichnos strands are present on either side of the vein. Young twigs of *L. scleroticum* show parichnos composed of 10–15 parenchyma cells, but in older cushions the parenchyma cells and phloem have decayed, leaving a cavity surrounding the lower parts of the xylem cells of the trace.

Several isolated fragments of leaf bases referable to *Lepidophloios* were also found in the Pyramid Mine coal-balls (fig. 24). Judging from the relatively few specimens found, however, this genus constituted but a minor element in the flora. A considerable number of well-preserved supposed *Lepidodendron* stems have been checked by means of sections taken through the leaf cushions to insure their correct identification. It is hoped that future collections may shed additional light on this *Lepidophloios* species.

An attempt has been made to correlate *Lepidodendron scleroticum* with certain of the large Lycopod trunk compressions occurring above the same coal seam in adjacent parts of Illinois. Approximately 25 specimens of stem compressions of various sizes were collected from the shale above coal ♯6 at the Old Ben Mine ♯11, Franklin County, Illinois. Exact specific determinations of impressions and compressions is difficult due to the varying degrees of preservation. It was possible, however, to separate the collection with reasonable accuracy into two species of *Lepidodendron* and one of *Lepidophloios*. The impressions of the leaf bases of *Lepidophloios laricinus* Sternberg closely resemble those of the petrified *Lepidophloios* figured. Of the two Lepidodendrons, *L. Volkmannianum* Sternberg ('25) compares more favorably with leaf bases of *L. scleroticum*. The other *Lepidodendron* impressions are probably *L. rimosum* Sternberg, for the leaf bases are slender. *Lepidodrendon Volkmannianum* (fig. 26) has been reported a number of times from the southern Illinois area, although it was described under different specific names (Lesquereux, '66, '70; Noé, '25).

The size of the impression specimens of *L. Volkmannianum* on the shale above the coal shaft makes a probable reconstruction possible. Figure 26 is one of the smaller stems, about 1½ inches in diameter. It was selected as an illustration because its size is comparable to the majority of the *Lepidodendron scleroticum* specimens, and although the trace and parichnos cannot be clearly observed the leaf scar is easily recognized. The stem branches dichotomously at the top, but the preservation of one branch is poor. Other specimens show leaf bases from ½ to ¾ inches wide. Judging from the size relationship of leaf bases and stem in the completely preserved impressions, these larger specimens would probably have measured 1–2 feet in diameter.

Economic Importance.—
In view of the fact that *Lepidodendron* stem remains are by far the most frequently encountered fossils in the Pyramid Mine coalballs it is of interest, economically, to note that the coal itself is in all probability composed very largely of the stems and leaves of this plant. Since the periderm constitutes the greater part of the stems it is that tissue which is largely responsible for this rich deposit of coal.

Diagnosis: Primary body protostelic to siphonostelic depending on stem size; secondary xylem present, abundantly so only around fully developed siphonosteles; inner cortex characterized by prominent sclerotic nests, outer cortex a reticulate sclerotic net in tangential section; massive periderm irregularly zoned by decay of less-resistant cells; leaf cushions resembling closely those of *L. Volkmannianum.*

Locality and Horizon: Pyramid Mine of the Binkley Coal Company, Perry County, Illinois; coal #6, Carbondale formation, middle Pennsylvanian.

Type specimens: WCB55 and WCB56, Washington University (St. Louis).

Lycopod Organs Associated with L. scleroticum.—
Leaves: Many Lycopod leaves were found preserved near the petrified *Lepidodendron* stems. Although the evidence strongly suggests their affinity with *L. scleroticum,* no stems were found actually connected with the Lycopod leaves. The leaves vary from 1

to 5 mm. in width. Although their shape is frequently distorted, all their internal tissues show the same general arrangement. The length of the leaves is impossible to determine accurately since they were curved and broken before petrifaction. Several could be measured from 2 to 3 cm. in length without any appreciable change in thickness.

The xylem occurs in a single horizontally elongated strand composed of 40–50 tracheids, the amount of xylem varying with the leaf size. The protoxylem cells are difficult to distinguish, but they probably occur along the abaxial margin of the bundle. The metaxylem consists of scalariform tracheids. The phloem is concentrated on the abaxial side of the xylem and in some cases may enclose the entire xylem strand. A bundle sheath of thick-walled sclerenchyma cells surrounds the vein but is especially concentrated near the phloem. Around the bundle sheath, but more pronounced on the lower side, is an additional sheath of transfusion cells from 4 to 6 layers thick. Their diameter is equal to or greater than the xylem tracheids. Parenchymatous cells of about the same size but without the thickenings are mingled with the transfusion cells.

The hypodermal layers, from 4 to 6 cells in thickness, add another unique character to the leaf structure. The tissue is composed of elongate sclerenchyma with transverse end walls, and presents a uniform transition from small, heavily thickened cells immediately beneath the epidermal layer, to larger, less-thickened ones composing the last few rows.

The stomatal grooves appear on either side of the thickened portion of the blade surrounding the vein. The sub-stomatal area consists of modified hypodermal cells with air passages between the groups of small rectangular cells.

The mesophyll is poorly-preserved but, as far as can be determined, it consists of more or less isodiameteric cells closely packed together. There appear to be no air spaces between cells in the blade itself, but there are large ones in the stomatal chamber. No evidence of differentiation into palisade and spongy tissue exists. The mesophyll, which was probably the only chlorophyllous tissue, constitutes a relatively small portion of the leaf.

Lycopod leaves have been described in this country by Graham ('35) and Reed ('41) under the generic name *Lepidophyllum*. These leaves, associated with *Lepidodendron scleroticum*, compare closely with *Lepidophyllum Thomasi* Graham.

Associated Fructifications: Several Lycopod microsporangiate cones and many seeds, one containing a well-preserved gametophyte, were found in the coal-balls. A complete description of these fossils has been presented under the name *Lepidocarpon magnificum* (Andrews and Pannell, '42). Although the evidence is incomplete it seems likely, on the basis of association, that these fructifications belong to *Lepidodendron scleroticum.*

Discussion.—

An observer of the abundant Lycopod remains of the Carboniferous period cannot help postulating an explanation for the extinction of that great flora. The climatic conditions of that era have been considered as producing a swampy habitat similar to the present-day great Dismal Swamp in Virginia. This belief is substantiated by the associated fern and horsetail remains occurring with the Lycopod fossils. The great abundance of Lycopod organs and the excellent preservation of the external surface of the stems give considerable evidence for the "in situ" origin and fossilization of the material.

A study of the petrified Lepidodendrons presents a striking variation from the usual concept of hydrophytic characters. The evolutionary tendency in these Lycopods was towards extreme bulk of dead cortical tissue. This tendency expressed itself in the stem by the bulky periderm and the small xylem and phloem cylinder, and in the leaves the hypodermal layer decreased the photosynthetic area. The apparent xerophytic modification of the leaves may have come about to prevent evaporation, not because of the scarcity of water but *because the small stele was unable to conduct rapidly enough.* The tree would be efficient under moist conditions as the seeds were probably quick to germinate and growth was apparently regular and rapid. But with the increasing dryness of the Permian period, the tree with its excessive modification in bulk and poor conducting and photosynthetic abilities rapidly became extinct.

Acknowledgement.—

The writer wishes to express her appreciation of the many services rendered by the staff of the Missouri Botanical Garden during the course of this work and is especially grateful to Dr. Henry N. Andrews for his patient guidance and constructive criticism. Thanks are also due the Binkley Coal Company for their continued good will and cooperation in allowing coal-ball collecting in the Pyramid Mine.

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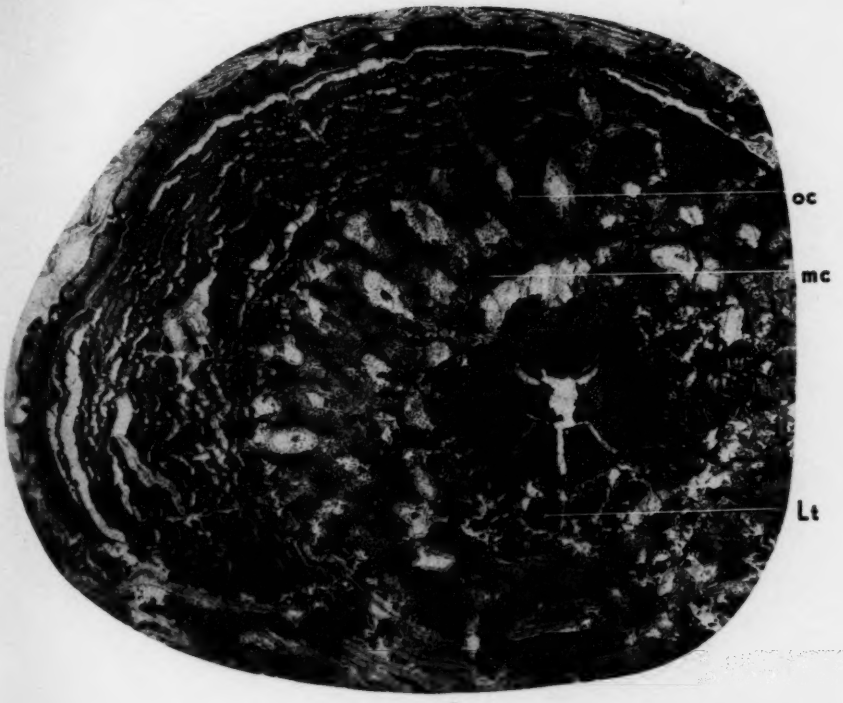
EXPLANATION OF PLATE

PLATE 18

Lepidodendron scleroticum

Fig. 1. Transverse section of stem: oc, outer cortex; mc, middle cortex; Lt, leaf trace. WCB55A.7, × 3.

Fig. 2. Longitudinal section of stem. WCB56I.20, × 3.



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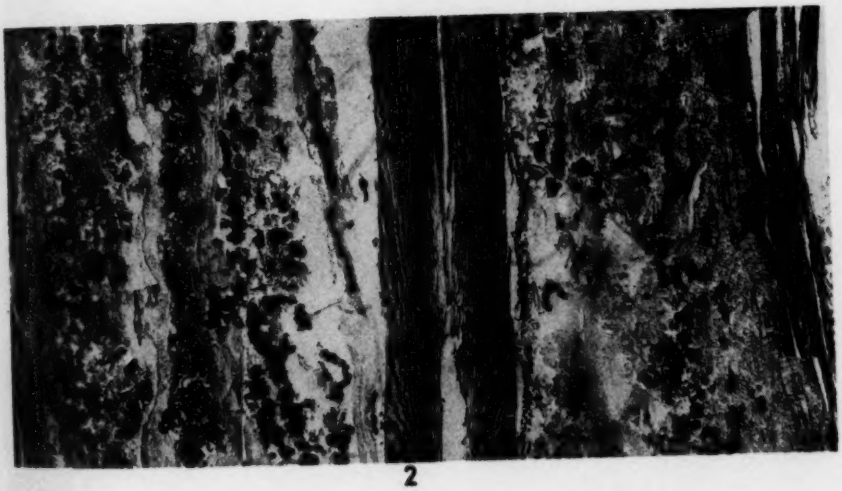

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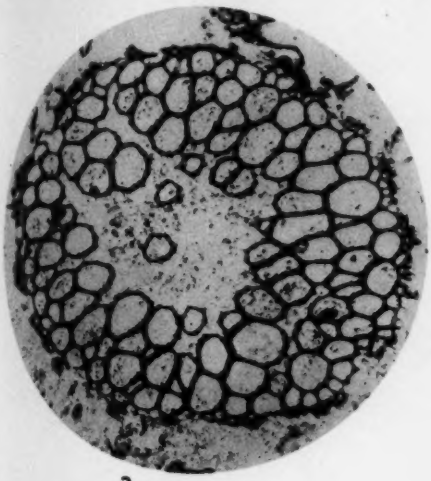
PANNELL—AMERICAN CARBONIFEROUS FLORAS. IV

EXPLANATION OF PLATE

PLATE 19

Lepidodendron scleroticum

Fig. 3. Transverse section of mixed protostele. MCB54.3, × 57.
Fig. 4. Transverse section through a portion of a large stele. WCB42.2, × 3.6.
Fig. 5. Macerated tracheids showing "vestured pits." Slide 1213, × 290.
Fig. 6. Transverse section of protostele. WCB54.3, × 57.
Fig. 7. Transverse section of siphonostele. WCB253E.B1, × 14.
Fig. 8. Transverse section through contact zone of primary and secondary xylem. WCB56B.7, × 57.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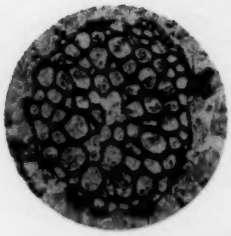
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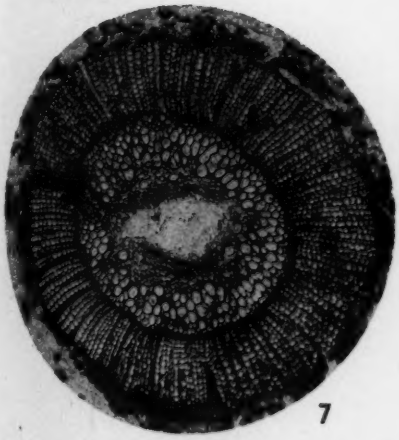
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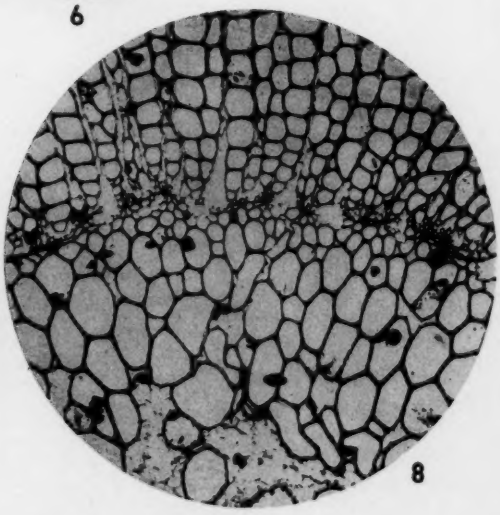
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PANNELL—AMERICAN CARBONIFEROUS FLORAS. IV

EXPLANATION OF PLATE

PLATE 20

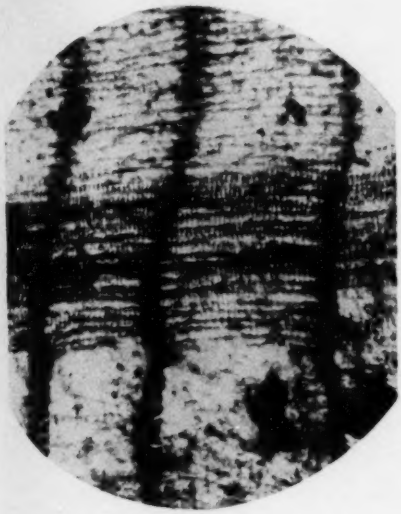
Lepidodendron scleroticum

Fig. 9. Leaf trace passing through secondary xylem, in radial section. WCB82B.83, × 100.

Fig. 10. Wood-ray cells in radial section. WCB90B.1, × 200.

Fig. 11. Transverse section through outer part of secondary xylem and phloem. WCB55A.10, × 75.

Fig. 12. Showing course of leaf trace from primary into secondary xylem. WCB56I.2, × 80.



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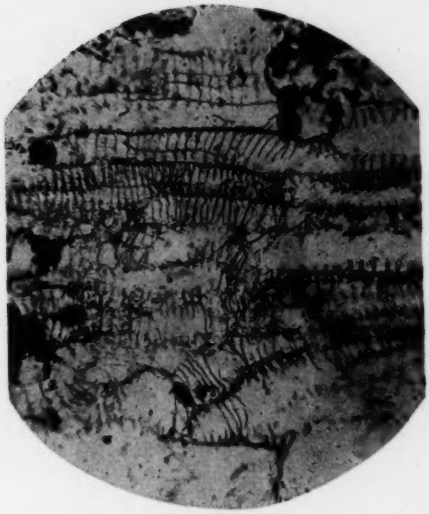

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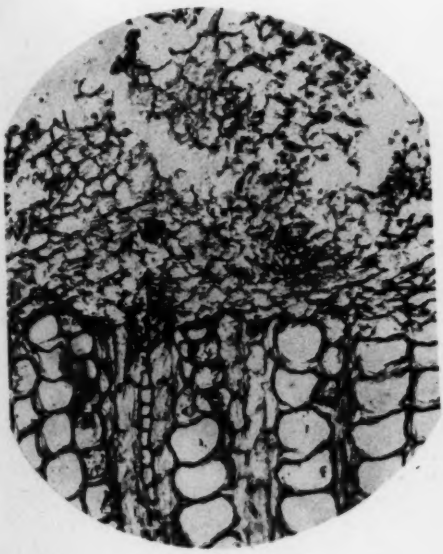

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PANNELL—AMERICAN CARBONIFEROUS FLORAS. IV

EXPLANATION OF PLATE

PLATE 21

Lepidodendron scleroticum

Figs. 13–16. Part of a series of peels tracing the origin and departure of a branch stele: p, periderm. All figures × 8.

Fig. 13. WCB253A.1.

Fig. 14. WCB253C.T2.

Fig. 15. WCB253D.T1.

Fig. 16. WCB253F.T2.

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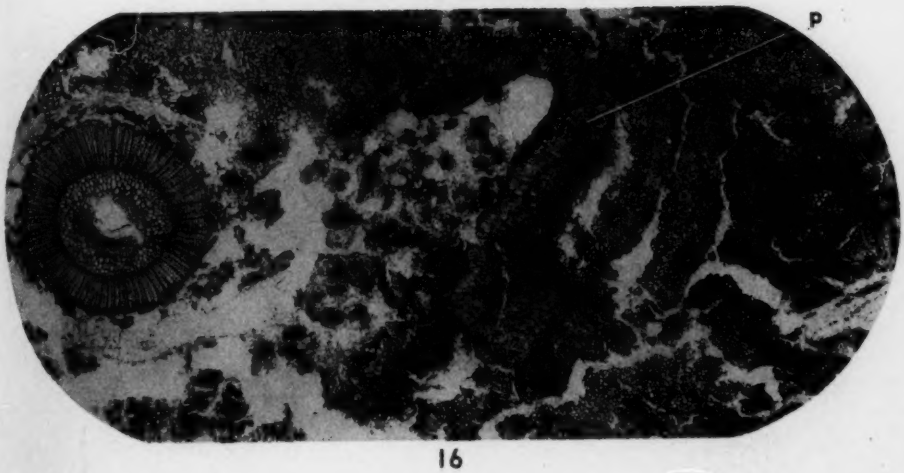

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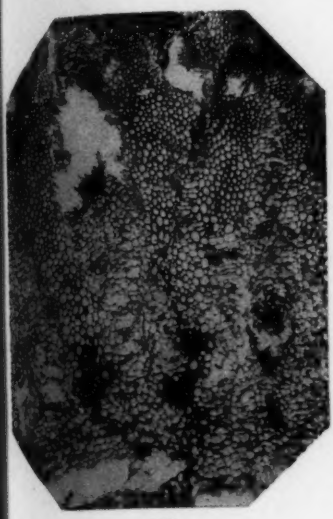
PANNELL—AMERICAN CARBONIFEROUS FLORAS. IV

EXPLANATION OF PLATE

PLATE 22

Lepidodendron scleroticum

Fig. 17. Transverse section of cortex. WCB55A.7, × 8.
Fig. 18. Radial section of cortex. WCB56I.20, × 8.
Fig. 19. Tangential section through central region of cortex. WCB55III.515, × 7.
Fig. 20. Tangential section through outer region of cortex. WCB56I.B2, × 5. See text for detailed explanation.



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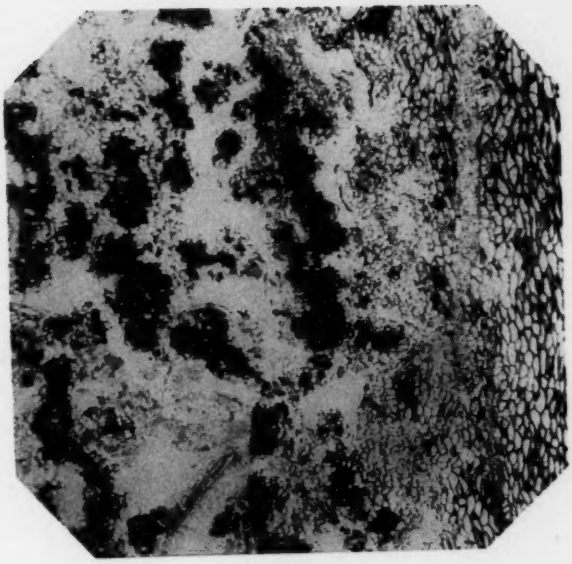

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PANNELL—AMERICAN CARBONIFEROUS FLORAS. IV

EXPLANATION OF PLATE

PLATE 23

Lepidodendron scleroticum

Fig. 21. Transverse section through young stem. WCB16C, × 10.

Fig. 22. Transverse section through periderm and leaf bases of a comparatively old stem. WCB55A.7, × 10.

Fig. 23. Transverse section through periderm and leaf bases of a young twig. WCB54A.8, × 40.

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23

PANNELL—AMERICAN CARBONIFEROUS FLORAS. IV

EXPLANATION OF PLATE

PLATE 24

Fig. 24. *Lepidophloios* sp. from the Pyramid mine, Perry County, Illinois. WCB58B.9, × 5.

Fig. 25. *Lepidodendron scleroticum*, tangential section through leaf cushions. WCB91.6, × 5.

Fig. 26. *Lepidodendron Volkmannianum* (?) from Franklin County, Illinois. No. 1447, × 1.

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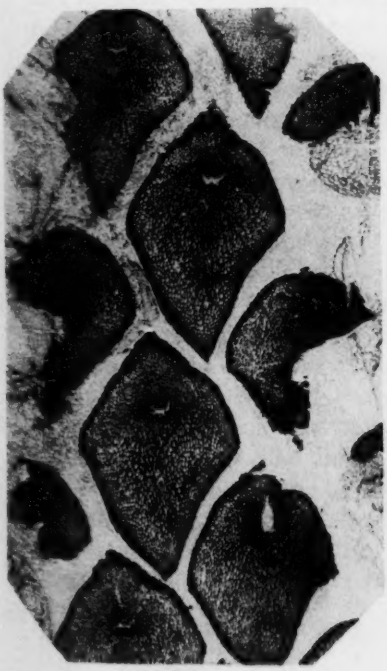

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PANNELL—AMERICAN CARBONIFEROUS FLORAS. IV

CONTRIBUTIONS TO OUR KNOWLEDGE OF AMERICAN CARBONIFEROUS FLORAS[1]

V. Heterangium

HENRY N. ANDREWS

Paleobotanist to the Missouri Botanical Garden
Assistant Professor, Henry Shaw School of Botany of Washington University

Our knowledge of Pteridosperm stem remains referred to the genus *Heterangium* is based chiefly on the earlier works of Williamson and Renault and the later detailed studies of Scott and Hirmer. Judging from its rather frequent occurrence in England, Scotland and on the Continent, the genus was well established throughout the greater part of the Carboniferous period.

Of the various plant organs that are assigned with some degree of certainty to the Pteridospermeae, *Heterangium* is of special significance because of its comparatively primitive structure as well as its occurrence in the early Calciferous Sandstone Series. It seems very likely that when its reproductive organs become better known we shall have a much clearer concept of how this early group of seed plants originated. An exhaustive review of the genus is unnecessary here inasmuch as the better-known species are adequately treated in certain of the standard texts and more detailed accounts may be found in the contributions of Scott ('17) and of Hirmer ('33). The latter work contains a useful key which outlines the major variations within the genus.

Although it has been known for some few years that *Heterangium* occurs in American Pennsylvanian coal-balls, no descriptions have been published. In 1935 Graham listed *H. tiliaeoides* as present in coal-balls from the McLeansboro horizon in Illinois, but his only comment relative to its occurrence was that, "Several stems were identified." In 1938 Fisher and Noé also reported *Heterangium* species from Calhoun coal-balls, but there were no accompanying descriptions. They also listed *H. Grievii* as having been found, which is rather surprising in view of its much earlier occurrence in the Calciferous Sandstone Series in Scotland. These brief references constitute, so far as I am aware, the only published accounts of the occurrence of the genus in America.

[1] Issued December 18, 1942.

Heterangium americanum, sp. nov.—

The following description is based on a number of stem and petiole remains found in coal-balls from the Calhoun coal, Richland County, Illinois. The locality is in the upper part of the McLeansboro formation and is of upper Pennsylvanian age. A single specimen of *Heterangium* has been collected by the author from the Herrin (No. 6) coal at the Pyramid Mine three miles south of Pinckneyville, Illinois. This constitutes the top of the Carbondale formation, and although it lies somewhat below the Calhoun coal (Schopf, '41, chart p. 9) this particular specimen is referable to *H. americanum*.

The specimens from Richland County consist of stem fragments bearing petioles, as well as isolated remains of both, and although the size and comparative development of secondary wood vary somewhat there are no distinctive features that necessitate segregation of the specimens into more than one species.

Primary Wood.—

The diameter of the primary xylem varies in different specimens from 1.75 mm. to 4 mm. As in the European species of *Heterangium*, the protoxylem groups occupy a position very close to the periphery. Where it is possible to distinguish the protoxylem with certainty a few primary tracheids can be observed external to it although these pass almost imperceptibly into the secondary xylem. The protoxylem thus occupies an excentrically mesarch position though it is very close to being exarch.

The large metaxylem cells (pl. 25, fig. 3), which average about 260 μ in diameter, are uniformly distributed throughout the parenchyma of the central cylinder. They may occur singly or in small groups of 2, 3 or 4 cells, but usually not more than that number except in the peripheral region where they pass into the protoxylem. The tracheids of the latter may be as small as 15 μ in diameter, while the secondary tracheids average about 65 μ.

The pitting of the primary tracheids differs in no way from that described for other species.

Secondary Wood.—

Some of the stems exhibit no secondary growth at all, while others show as much as 5 mm. (figs. 1, 4). The wood rays vary greatly both in height and breadth as well as in the size of the component cells. Text-fig. 2, drawn with the aid of a camera-lucida, shows a representative tangential section. The rays may consist of but a

1

Text-fig. 1. *Heterangium americanum:* A drawing prepared with the aid of a camera lucida showing division of the lateral and lobing of the central trace branches in a petiole. CB386.C.T11, × 17.5.

single row of cells while others are uniseriate but attain a height of 3 mm. or more. One such slender ray may be observed near the right-hand side extending the entire height of the figure. Elongate fusiform bi- or triseriate rays are common and may even reach a width of 6 or 7 cells although all of these broad rays that were observed were undergoing division.

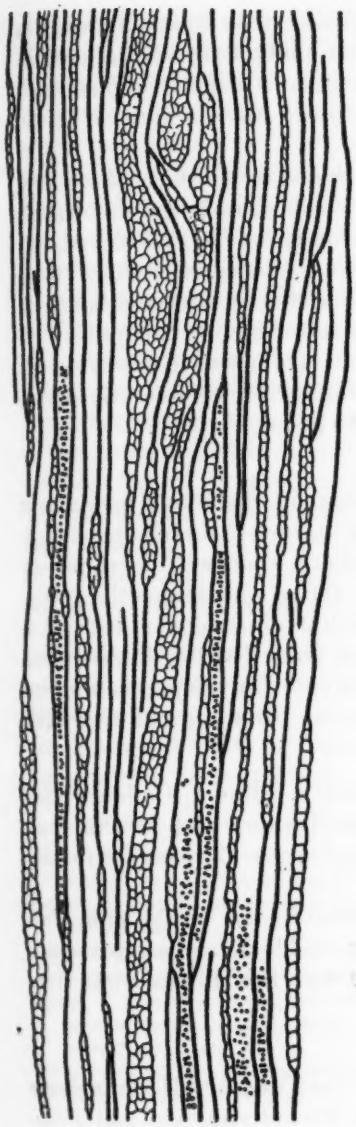
The radial walls of the tracheids are characterized by closely compacted angular pits (text-fig. 4) like those found in other species of *Heterangium,* as well as certain other probably closely related Pteridosperms such as *Lyginopteris, Rhetinangium* and *Stenomyelon.* The pit borders are not well preserved in the radial walls, but where they can be observed the orifice appears to be rather broadly oval-shaped and horizontally elongated.

The pits in the tangential walls are quite distinct from those in the radial walls, being nearly circular and loosely arranged in 1, 2 or 3 rows (text-fig. 3). The narrow orifice extends almost the entire diameter of the pit, and forms a cross with the pit in the wall of the adjacent tracheid.

Leaf Trace and Petiole.—

Owing to the fact that all the stems and petioles are short fragments, it has not been possible to follow any individual leaf trace from its origin in the stele out into the petiole. However, a sufficient number of specimens showed various stages in the course of the trace to give a reasonably complete picture of its anatomy.

The leaf trace originates from the periphery of the primary xylem as two distinct bundles about two mm. apart (text-fig. 5). They start to divide almost immediately and are two-lobed at the time of their departure from the stele. In their passage through the cortex the division is completed and four separate bundles enter the base of the petiole (fig. 2). The outer or lateral branches (fig. 2, L_1, L_2) resulting from the first division then divide into two small bundles which pass out toward the wing of the petiole (fig. 5, L_{1a}, L_{1b}; text-fig. 1). The two central bundles (fig. 2, c_1, c_2) resulting from the first division then start to divide into three bundles each (fig. 5; text-fig. 1). That this division began prior to the separation of the petiole from the stem is evidenced in text-fig. 1 which represents a petiole still connected to its stem. One of the large central bundles is clearly three-lobed while the other has not quite reached this stage. Another petiole found isolated (fig. 5) exhibits the three-lobed condition in both bundles. No specimens have been



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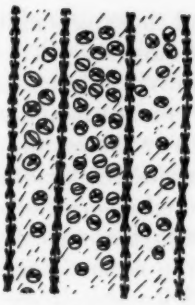

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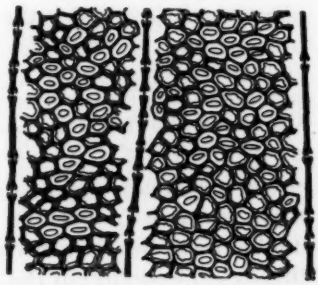

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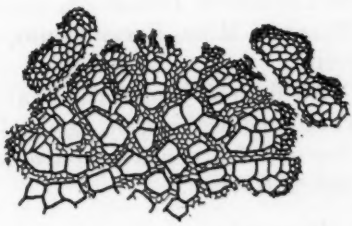

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Text-figs. 2–5. *Heterangium americanum:* fig. 2, tangential section through the secondary wood. CB542.B1.F48, × 62; fig. 3, pitting in the tangential walls of the secondary tracheids. CB542.B1.F48, × 265; fig. 4, pitting in the radial walls of the secondary tracheids. CB542.B1.F48, × 265; fig. 5, portion of a stele in transverse section showing the two traces that will enter a petiole. CB386.D2.T10, × 17.5.

found showing a higher level of the petiole than that illustrated in this figure. It seems very likely, however, that the two central strands soon divided, resulting in a total of ten at a slightly higher level. No evidence is available pertaining to the further division of the traces or the petiole as a whole.

Outside the bundles of the petiole shown in text-fig. 1 there may be noted a series of sclerotic nests embedded in large, thin-walled parenchymatous cells. The outer cortex is not well preserved, but judging from the more or less regular sequence of cavities (text-fig. 1) it seems likely that this zone consisted of alternate bands of fibrous and parenchymatous cells, the latter having decayed.

The extra-stelar tissues of the stems are not well preserved although specimen CB542 displayed the horizontal sclerotic plates characteristic of the outer cortex of the genus.

Diagnosis.—

Primary xylem from 1.75 to 4. mm. in diameter, metaxylem tracheids about 260 μ in diameter and uniformly distributed singly or in groups of 2, 3 or 4 cells; secondary wood well developed in some specimens, tracheids pitted on radial and tangential walls, rays variable in vertical and tangential dimensions; leaf trace double from the time of its origin, each trace dividing in its course through the cortex; of the four bundles entering the petiole the two central ones become three-lobed while the two marginal ones each divide to form two distinct bundles.

Locality and horizon: Richland County, Illinois; Calhoun coal, McLeansboro formation, upper Pennsylvanian and Herrin coal, Pyramid Mine, Perry County, Illinois; upper Carbondale formation.

All figured preparations are preserved in the Washington University collections, St. Louis. The original blocks and a representative set of preparations are deposited with the Illinois State Geological Survey.

Discussion.—

In his consideration of the British Coal-Measure Heterangiums Scott ('17) proposed the sub-genera *Eu-heterangium* and *Polyangium* to include those species characterized by having the vascular system of the petiole originate as a single or double bundle respectively. Hirmer ('33) recognizes six species in the *Polyangium* group, in which *H. americanum* belongs. The two German species,

H. Kukuki and *H. Hoppsteadteri,* differ rather strikingly from the Illinois *Heterangium* in the arrangement of the metaxylem tracheids. In the last they usually occur in 2- or 3-celled groups which are uniformly distributed. The contrast is especially true in *H. Kukuki,* where the tracheid cells are in large groups of 10 or more and the groups are separated by prominent parenchymatous "ravs" (cf. Hirmer, '33, pl. 8, fig. 2).

The affinities of the Illinois species seem to lie close to the English *H. tiliaeoides* and *H. shorense.* Graham recognized this relationship when he assigned his specimen to the former. The small size of the metaxylem tracheid groups in *H. americanum* offers a character which likewise sets it apart from these English Heterangiums and which I believe is worthy in itself of specific distinction. Another feature, however, that has not been described for the other species is the apparent tri-partite branching of the central traces in the petiole (fig. 5). It may be, of course, that comparable portions of the petiole are present among the English specimens but until such is shown to be the case this may be considered as characteristic of *H. americanum.* In view of these differences it seems advisable to assign this new specific name to our specimens.

Acknowledgement.—

I wish to express my appreciation to the Illinois State Geological Survey, and especially to Dr. James M. Schopf of that organization, for the opportunity of studying and describing these American specimens of *Heterangium.*

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EXPLANATION OF PLATE

PLATE 25

Heterangium americanum

Fig. 1. Slightly oblique transverse section showing well-developed secondary wood. CB542.A1.S13, × 8.5.

Fig. 2. Transverse section of a portion of a stem and attached petiole. CB386.D.T21; L_1, c_1 and L_2, c_2 are the branch traces resulting respectively from the two traces entering the petiole, × 8.5.

Fig. 3. Stele of same, × 12.

Fig. 4. A smaller stem showing secondary wood. CB323.A2.S9, × 8.5.

Fig. 5. An isolated petiole showing partial division of the central trace branches. CB323.A2.S9, × 8.5.

Photographs by Eloise Pannell.

ANDREWS—AMERICAN CARBONIFEROUS FLORAS. V

A FOSSIL ARAUCARIAN WOOD FROM WESTERN WYOMING[1]

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AND ELOISE PANNELL

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A few years ago the senior author made a collection of silicified woods from the Gros Ventre Canyon in western Wyoming. We were attracted to the region partly by some petrified log fragments on display outside the Jenny Lake Post Office, which were said to have been collected in the canyon, and partly by a landslide that presents a conspicuous scar on the lower end of the canyon, a landmark readily seen from the vicinity of Teton Park. Although two visits to the slide area failed to reveal anything of paleobotanical interest, certain regions farther up the canyon proved more productive. Approximately twelve miles up the road there is a second and considerably older slide now partially concealed by a fairly heavy vegetation. When this older landslide occurred the Gros Ventre Canyon was blocked and a lake formed in Cole Hollow.

At the time of our 1936 visit a petrified trunk some three feet in diameter was exposed approximately 200 yards from the south bank of the river. The slide area was subsequently followed up to its apparent origin, a point about one mile from the river (Mt. Leidy quadrangle, R 112 W, T 42 N). There, a small badlands area, some few acres in extent and light gray color, is quite prominent when viewed from the opposite side of the valley. Sections of silicified trunks and small twigs are comparatively abundant in the gullies, weathering out of rocks of Cretaceous age. A more precise determination of the horizon is not possible at present, since neither the stratigraphy nor paleontology of the region has been studied in detail.

Very small-scale coal-mining operations have been carried out on the opposite side of the river, likewise in Cretaceous strata. A seam some four feet thick outcrops about one-half mile north of the river and has been exploited in the past. The seam includes a number of bands of sandy clay some of which contain fern and dicot

[1]Issued December 18, 1942.

leaf impressions. However, the matrix is very friable near the surface, although it might be possible to obtain better specimens if deeper excavations were made.

The silicified woods in our collection include both dicotyledons and conifers. No attempt has been made to identify the former. The coniferous specimens include at least two distinct species. One of these is referable to *Cupressinoxylon* but, because of its otherwise indeterminate natural affinities, will not be considered, and the other can with reasonable certainty be placed in the Araucariaceae.

Araucarioxylon wyomingense sp. nov.—

Annual rings.—Present but indistinct, defined only by 2–3 rows of slightly thicker-walled summer cells (pl. 26, fig. 5).

Resin canals.—Absent.

Wood parenchyma.—Absent.

Wood rays.—Strictly uniseriate and mostly only 1–3 cells high (fig. 3); cross field pitting of the cupressoid type.[2]

Tracheids.—Quite constant in size throughout the annual ring, average 18 × 21 μ (tangential and radial dimensions respectively) in transverse section. Pitting uniseriate and biseriate, pits closely crowded and angular when biseriate (figs. 1, 2, 4, 6), crassulae absent, tangential pitting absent.

Type.—Slides 617, 623, and 631, radial, tangential, and transverse sections respectively, from a fragmentary specimen, Washington University, St. Louis.

The description is based on small fragments as well as a section of a trunk 9 inches in diameter and 5 inches long (No. 1396). Although this is the largest specimen in our collection it is a decorticated one and was evidently somewhat larger in life.

The most distinctive feature of the wood lies in the diminutive size of the rays. In a total of over 700 rays counted from four different slides 50 per cent were but one cell high, 28 per cent two cells high, 12 per cent three cells high, while only 10 per cent were more than three cells high. They present a striking appearance when viewed in tangential section as may be noted in fig. 3. This ray structure is quite distinct from that of any other described Araucarian wood and constitutes the chief basis of our specific designation. The supposed Araucarian relationships of the species are supported by the weakly defined annual rings, the cupressoid type cross field pitting and especially the tracheidal pitting.

[2] Phillips, E. W. J. The identification of coniferous woods by their microscopic structure. Jour. Linn. Soc. Bot. **52**: 259–314. 1941.

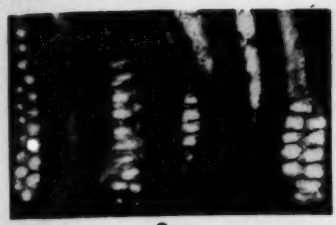
EXPLANATION OF PLATE

PLATE 26

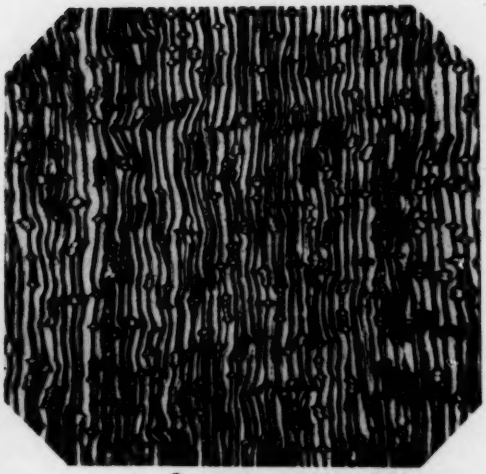
Araucarioxylon wyomingense

Figs. 1, 2, 4, 6. Pitting in the radial walls of the secondary tracheids. Slide 617, × 300.
Fig. 3. Tangential section. Slide 623, × 56.
Fig. 5. Transverse section. Slide 631, × 22.

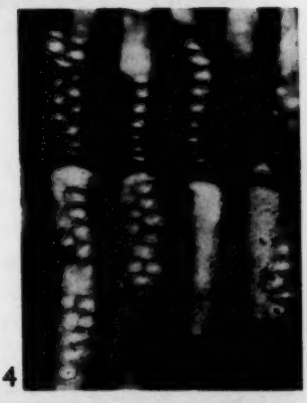
1



2

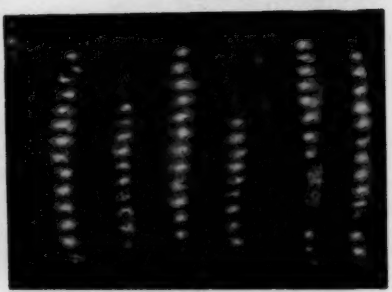


3



4

5



6

ANDREWS & PANNELL—FOSSIL ARAUCARIAN WOOD

MONOGRAPH OF SCHOENOCAULON[1]

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Introduction

Interest in a monographic treatment of the genus *Schoenocaulon,* a member of the Liliaceae, tribe Veratreae, was aroused by the state of taxonomic confusion into which it had fallen. Though the first plants of this genus were discovered more than a hundred years ago and more have been constantly collected since then, no monographic study has as yet been made of *Schoenocaulon.* From time to time new species were described which, in some cases, only increased the confusion. The problem resolved itself into a delimitation of the genus, a determination of the true generic name, the study of the morphological features which distinguish the species, and the geographical distribution of the genus as a whole and of the several species.

History of the Genus

The genus *Schoenocaulon* was first proposed by Asa Gray in 1837. It was based on *Helonias dubia* Michx. Michaux gave us the first description of the plant in 1803.[2] He had his doubts as to the genus when he designated some plants from Georgia and Florida as *Helonias dubia.* Willdenow,[3] Pursh,[4] Nuttall,[5] and others considered the species as doubtful *Helonias.* Later Gray made the segregation but called the plant *Schoenocaulon gracile.*[6]

Schiede and Deppe collected some plants on the eastern side of the Mexican Sierras. These were recorded by Schlechtendal and Chamisso as *Veratrum,* and in 1831 they proposed *Veratrum officinale* as a new species.[7] Hartweg found some more in the neighbor-

[1] A dissertation carried out in the Graduate Laboratories of the Henry Shaw School of Botany of Washington University and submitted as a thesis in partial fulfillment of the requirements for the degree of master of science in the Henry Shaw School of Botany of Washington University.

[2] Michx. Fl. Bor. Am. 1: 213. 1803.

[3] Willd. in Ges. Naturf. Freunde Berlin, Mag. 2: 29. 1808.

[4] Pursh, Fl. Am. Sept. 1: 244. 1814.

[5] Nuttall, Gen. N. Am. Pl. 1: 234. 1818.

[6] Gray, Ann. Lyc. N. Y. 4: 127. 1837.

[7] Schlecht. & Cham. in Linnaea 6: 45. 1831.

Issued December 18, 1942.

hood of Vera Cruz and sent them to the Royal Horticultural Society of London. Lindley had no doubt that these were the same as Schiede and Deppe's plants. However, he saw they were not of the genus *Veratrum* and proposed the name *Asagraea officinalis*.[8] No sooner had Dr. Gray seen the illustration and description of the plant than he realized that it belonged to his genus *Schoenocaulon*. Examination of Schiede and Deppe's specimen confirmed his opinion.[9] When in 1836 [1837] Brandt and Ratzeburg treated *Veratrum officinale*[10] they inserted a footnote calling this plant *Sabadilla officinarum*, but they used *Sabadilla* as a subgeneric name in their main description.

The next species appeared in literature in 1838 when Schlechtendal described an Ehrenberg specimen as *Veratrum caricifolium*.[11] Six years later Schlectendal tried to correct his generic designation and change the name to *Sabadilla caricifolia*.[12] But he was too late, for Gray in 1840 had examined the same specimens and rightfully called them *Schoenocaulon caricifolium*.[13]

Schoenocaulon Drummondii was described by Gray in 1840, from a plant in Drummond's Texas collection.[14] The species *Schoenocaulon tenuifolium* was first called *Veratrum tenuifolium* by Martens and Galeotti in 1842,[15] and *Asagraea tenuifolia* by Kunth a year later.[16] Robinson and Greenman made the proper combination in 1895.[17]

Lindheimer collected Texas plants in the spring of 1846 and sent them to Scheele who called no. 543 *Schoenocaulon texanum*.[18] From this description Gray mistook the plant for his *S. Drummondii* and reduced *S. texanum* to synonymy.[19] These two species were continually confused until 1916, when Pennell pointed out their several points of difference.[20]

Schoenocaulon Coulteri is the name given by Baker in 1879 to a

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[8] Lindl. in Edwards' Bot. Reg. **2**: *t.33*. 1839.
[9] Gray in Hook. & Arn. Bot. Beechey's Voy. 388. 1840.
[10] Brandt & Ratzeb. in Hayne, Darstel. v. Beschreib. d. Arzneig. **13**: *t.27*. 1836. [1837].
[11] Schlecht. in Ind. Sem. Hort. Hal. 8. 1838.
[12] Schlecht. in Linnaea **18**: 444. 1844.
[13] Gray in Hook. & Arn. Bot. Beechey's Voy. p. 388. 1840.
[14] Gray in Hook. & Arn. Bot. Beechey's Voy. 388. 1840.
[15] Mart. & Gal. in Acad. Roy. Brux. Bul. **9**[2]: 380. 1842.
[16] Kunth, Enum. Pl. **4**: 700. 1843.
[17] Robins. & Greenm. in Am. Jour. Sci., III, **50**: 168. 1895.
[18] Scheele in Linnaea **25**: 262. 1852.
[19] Holographic notes of Dr. A. Gray, in Libr. Mo. Bot. Gard.
[20] Pennell in Bull. Torrey Bot. Club **43**: 408. 1916.

plant which Coulter found near Zimapan, Mexico.[21] Hemsley[22] and Kuntze[23] have the only other references in literature to this plant. Greenman described the next species, *S. Pringlei,* in 1897[24]; and *S. calcicola, S. Ghiesbreghtii* and *S. jaliscense* in 1907.[25] The most recent description is that of *S. megarhiza* by Marcus E. Jones in 1912.[26]

Schoenocaulon intermedium has had a career of confusion ever since its description by Baker in 1879.[27] Various plants have been placed in and taken out of the species. The original description was too general and the type specimens so poor that no definite idea of the real species could be formed. Evidence seems to point to the correctness of Hemsley's statement that "probably *S. intermedium* may not be a distinct species"[28] and should be reduced to synonymy under *S. texanum.*

Morphology

The bulb of *Schoenocaulon* is generally egg-shaped and covered with either dark, thin, dry scales, as in *S. Drummondii* and *S. dubium,* or, as is more common, by a tangle of fibers. The fibers are the fibro-vascular bundles which persist after the mesophyll of the first leaf-bases has decomposed. In young plants these fibers are not thickly coated over the bulb and around the base of the leaves, but in plants several years old they show specific characters in the density, color and texture. Some species, for example *S. jaliscense,* have fine and rather soft fibers, while others, as *S. comatum,* are characterized by coarse and stiff fibers forming mats which resemble hanks of horsehair.

The grass-like leaves are all basal and afford specific characters as to length and breadth only when the average can be taken from a number of full-grown plants. The intergradation between a short leaf of a long-leaf species and an unusually long leaf of a short-leaf species makes leaf characters quite unsatisfactory for classification. As to number of veins in a leaf, it has been found impossible to use the character of venation with any degree of satisfaction.

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[21] Baker in Jour. Linn. Soc. Bot. **17**: 477. 1879.
[22] Hemsl. in Salvin & Godman, Biol. Cent.-Am. Bot. **3**: 383. 1885.
[23] Kuntze, Rev. Gen. Pl. **2**: 713. 1891.
[24] Greenm. in Proc. Am. Acad. **32**: 295. 1897.
[25] Greenm. in Proc. Am. Acad. **43**: 19–20. 1907.
[26] Jones, Contr. West. Bot. 14: 29. 1912.
[27] Baker in Jour. Linn. Soc. Bot. **17**: 477. 1879.
[28] Hemsley in Salvin & Godman, Biol. Cent.-Am. Bot. **3**: 382. 1885.

Extreme cases of narrowness or breadth, as in *S. tenue* and *S. officinale* respectively, coupled with other features, may be of value in determining some of the species.

The scape is always naked, straight, and terete above. Usually the base is somewhat angled because of the pressure exerted on it in the bulb.

Some of the most valuable diagnostic features are to be found in the inflorescence, particularly its length and its diameter at anthesis. Other points to be noted are the disposition and spacing of the flowers on the axis, whether evenly or irregularly placed, whether crowded or distant from each other. In some species, as *S. regulare*, the flowers are all uniform in position and mature simultaneously. Other species, as *S. texanum* or *S. officinale*, have the lowermost flowers fruiting before those at the tip of the spike shed their pollen.

The six perianth segments are, with the exception of *S. Conzattii*, *S. Ghiesbreghtii*, *S. Pringlei*, and *S. tenuifolium*, about 2–3 mm. in length. *Schoenocaulon tenuifolium* is the only species with broadly ovate perianth-segments. All the other species have either ligulate or narrowly ovate segments. It is the margins of the segment which affords the most valuable character for specific determination. *Schoenocaulon Drummondii*, *S. tenuifolium* and *S. yucatanense* are erose-margined; *S. comatum*, *S. dubium*, and *S. officinale* are entire-margined; the majority of the species have a single hyaline tooth projecting from the sides of the segment near the base; others, such as *S. Ghiesbreghtii*, have two teeth on each margin. *Schoenocaulon Pringlei* is subscarious-margined and *S. caricifolium* is subdentate-margined. In all species, except *S. officinale*, the nectary gland is too inconstant and inconspicuous a character to be of much value.

The hypogynous stamens are six in number with large, reniform, single-celled anthers. In most species the filaments are twice the length of the perianth, while in *S. megarhiza*, *S. obtusum*, and *S. Pringlei* they scarcely project at all, and *S. yucatanense* has filaments three times as long as the perianth.

The mature fruit of most of the species is ovoid and somewhat inflated. *Schoenocaulon macrocarpum* has a capsule which is more linear than oval; that of *S. caricifolium* and *S. tenuifolium* shows marked inflation. The former has a regular oval shape, whereas the latter is obovate.

The seeds, if mature and obtained in sufficient abundance, may perhaps furnish added traits for determination of the species.

Economic Importance

The entire plant is poisonous, particularly the seeds, which are without odor but have an acrid burning taste. The medicinal virtue of the seed is due to the alkaloid veratrine. Tinctures, extracts, and powders were once made from the seeds and used for rheumatism, paralysis, cardiac conditions, dropsy, and as a taenicide. Because it is such a drastic purgative and productive of such severe vomiting and internal bleeding it has been discarded as a remedy in internal medicine. Several deaths from its employment have been recorded. Its use nowadays is restricted to veterinary medicine or for destroying body lice and other vermin. Specimens received recently from H. S. Gentry bear the following notation concerning the plants he collected in Sinaloa, Mexico: "Roots employed for killing maggots in wounds; powdered and applied or decocted as a wash."

Related Genera

Schoenocaulon has been confused with several genera, particularly *Helonias, Veratrum, Tofieldia,* and *Zygadenus.* The following tabulation will furnish some salient morphological features useful in distinguishing *Schoenocaulon* from related genera.

Schoenocaulon: Base of plant a fibrous-tunicate bulb; leaves basal, narrow; scape simple; flowers disposed in a spike or dense raceme; perianth-segments glandular or eglanular.

Helonias: Base of plant a short tuberous root-stock; leaves basal, broad and fleshy; scape simple; flowers disposed in a raceme; perianth-segments not glandular.

Veratrum: Base of plant a fibrous-tunicate bulb; leaves cauline, broad; inflorescence a dense terminal panicle; perianth-segments not clawed, eglandular.

Tofieldia: Base of plant a short creeping rhizome; leaves 2-ranked, equitant; flowers disposed in a dense raceme or spike; perianth-segments not clawed.

Zygadenus: Base of plant a rhizome or a tunicated bulb; leaves basal, linear; scape branched; flowers disposed in an open panicle; perianth-segments glandular, distinctly clawed.

GEOGRAPHICAL DISTRIBUTION

Schoenocaulon has been found in the southernmost parts of the United States, in Mexico, Central America, and in two states of South America.

Schoenocaulon dubium is the only Floridan species. *S. Drummondii* and *S. texanum* are found in Texas and northern Mexico. The latter species grows as far north as the southeastern counties of New Mexico. The widest distributed species is *S. officinale,* having been collected in Mexico, throughout Central America, and in parts of Venezuela and Peru.

The paucity of specimens makes an adequate distribution picture of the genus *Schoenocaulon* impossible. Those states of Mexico and Central America which have been more extensively botanized have contributed a greater number of species. Gaps between localities where such species as *S. comatum* and *S. regulare* are found indicate the need of more field work and collecting.

COMMON NAMES

Schoenocaulon has a number of common names, such as: Green Lily (Texas), Feather-shank (Florida), Sabadilla, Sabadille, Cebadilla, Cevadille, Cevadilha, Matu Curros, Semen Sabadillae, Sabadillsamen, Capuziner Samen, Laeusekraut, Mexicanischer Laeusesamen and several others.

ABBREVIATIONS

Sincere appreciation is expressed to all those institutions whose cooperation and facilities have made this work possible. The herbaria cited in this monograph are indicated by the following abbreviations:

CA—California Academy of Sciences.
D—Dudley Herbarium of Stanford University.
F—Field Museum of Natural History.
G—Gray Herbarium of Harvard University.
M—Missouri Botanical Garden.
P—Pomona College.
PA—Academy of Natural Sciences of Philadelphia.
UC—University of California, Berkeley.
US—United States National Herbarium.

TAXONOMY

Schoenocaulon Gray in Ann. Lyc. N. Y. **4**: 127. 1837; Endl. Gen. Pl. 1357. 1840; Meisn. Pl. Vasc. Gen. **1**: 405. 1836-43; Kunth, Enum. Pl.

4:185. 1843; Chapm. Fl. South. U. S., 490. 1860; Baker in Jour. Linn. Soc. Bot. **17**: 476. 1879; Benth. & Hook. f. Gen. Pl. **3**: 836. 1880; Hemsl. in Salvin & Godman, Biol. Cent.-Am. Bot. **3**: 383. 1885; Engl. & Prantl, Nat. Pflanzenfam. **II.** 5: 23. 1888; Small, Fl. Southeast. U. S. 250. 1903, and ed. 2, 1913; Small, Man. Southeast. Fl., 277. 1933.

Veratrum Schlecht. & Cham. in Linnaea **6**: 45. 1831, not L.

Helonias Don in Edinb. N. Phil. Jour. 234. 1832, not L.

Sabadilla[29] Brandt [Brandt & Ratzeburg] in Hayne, Arzneig. **13**: *t. 27.* 1836 [1837], as subgenus; Schlecht. in Linnaea **18**: 444. 1844, as genus; Kuntze, Rev. Gen. Pl. **2**: 713. 1891; Dalla-Torre & Harms, Gen. Siph. 60. 1900–1907; Engl. & Prantl. Nat. Pflanzenfam. ed. 2, **15a**: 261. 1930.

Skoinolon Raf. Fl. Tellur. **4**: 27. 1836, nomen prius.

Asagraea Lindl. in Edwards' Bot. Reg. **2**: *pl. 33.* 1839; Hook. & Arn. Bot. Beechey's Voy. 388. 1840; Kunth, Enum. Pl. **4**: 184. 1843; A. Rich. in Orb. Dict. **2**: 199. 1845; Spach in Hist. Nat. Veg. Phan. **12**: 245. 1846, not *Asagraea* Baill. in Adansonia **9**: 233. 1870.

DESCRIPTION OF THE GENUS

Herbaceous perennials; bulb oblong to ovoid; basal portion of the plant surrounded by a cylindrical covering of brownish-black to black scales and fibers, the remnants or the first bulb-scales and outer leaves; leaves all basal, grass-like, long and narrow, attenuate into a hair-like tip, flat, coarsely and strongly nerved, firm in texture, glabrous on both sides, slightly or not at all glaucous, margins serrulate; scape erect, simple, naked, glabrous, glaucous and terete above, purplish and angled below; spike virgate, many-flowered, bracteate, terminal portion bearing sterile flowers; bracts small, solitary, partly clasping the axis, broad-triangular or deltoid, rounded or acuminate-tipped, thin, scarious, dull hyaline, erose-margined; flowers perfect, at first crowded, later more or less scattered, regular, small, erect, sessile or on short stout pedicels, base

[29] Brandt and Ratzeburg, in 1836 [1837], in Hayne's 'Darstellung und Beschreibung der Arzneigewächse,' recognized *Veratrum officinale* Schlecht. as a valid name and described and illustrated this plant in detail. *Sabadilla* was definitely included as a subgenus of *Veratrum*. In a footnote they suggested the possible binominal *Sabadilla officinarum*. This name, however, is accompanied by the following statement. "Es schien uns daher besser, für jetzt ein Subgenus! unter dem Namen *Sabadilla* vorzuschlagen, um jene auffallenden Eigenthümlichkeiten anzudeuten." Since *Sabadilla* was here placed in the rank of subgenus it cannot, according to the International Rules of Botanical Nomenclature, supersede the generic name of *Schoenocaulon* Gray which was validly published in 1837.

broadly bell-shaped to hemispherical, pale green to yellowish-white; perianth-segments 6, hypogynous, cyclic, subequal, sessile, free or scarcely united at the base, somewhat spreading, persistent, faintly 3–5-nerved, leathery to scarious, obtuse, oblong to narrowly linear, entire, subentire, 1–2-dentate on either margin, or erose, often hyaline-margined, glandular or eglandular; stamens 6, hypogynous, subequal, inserted at the base of the perianth-segments, persistent, erect; filaments filiform, yellow to purplish-red, awl-shaped, at first short, later elongating, recurved; anthers large, versatile, yellow, reniform before dehiscence, later clypeolate or peltate, unilocular, extrorse; ovary ovoid, constricted at the base, superior, free from the perianth and stamen-cycle, tricarpellary; ovules 6–8 in each cell, biseriate, axillary, ascending, anatropous; styles 3, distinct, divergent, slightly recurved, short, tapering to the apex; stigma terminal, simple, minute; capsule ovoid to oblong, acuminate, chartaceous, glaucous, persistent, 3-celled, septicidally dehiscent, pedicels when present stout, recurved or ascending; seed ovate to slender-oblong, nearly terete, often curved, slightly winged at the apex, coat corrugated, dark brown and shiny, 1–5 superposed and compressed in each cell, albumen firm, embryo minute, near the hilum.

Type species: **Schoenocaulon dubium** (Michx.) Small, Fl. Southeast. U.S., 250. 1903 *(S. gracile* Gray in Ann. Lyc. N. Y. **4**: 127. 1837).

KEY TO THE SPECIES

A. Perianth-segments ligulate, margins not toothed; nectaries prominent.....*14. S. officinale*
AA. Perianth-segments ligulate to ovate, margins with or without teeth; nectaries absent or not prominent.....B
B. Inflorescence 15–20 mm. in diameter.....C
C. Perianth-segments ovate, 3 mm. broad.....*18. S. tenuifolium*
CC. Perianth-segments ligulate, 1 mm. broad.....D
D. Perianth-segments with erose margins.....*6. S. Drummondii*
DD. Perianth-segments with entire or with few-toothed margins.....E
E. Flowers crowded on the spike.....*8. S. Ghiesbreghtii*
EE. Flowers loosely disposed on the spike.....*4. S. Conzattii*
BB. Inflorescence 5–15 mm. in diameter.....C
C. Perianth-segments with erose margins.....*20. S. yucatanense*
CC. Perianth-segments not erose-margined.....D
D. Perianth-segments obscurely or not at all dentate, not scarious-margined...E
E. Bulb covered with coarse stiff fibers; scape 15–30 cm. long.....F
F. Scape 15–17 cm. long; capsules strongly inflated....*2. S. caricifolium*
FF. Scape 18–30 cm. long; capsules not strongly inflated....*3. S. comatum*
EE. Bulb covered with scales or fine fibers; scape 30 cm. or more long.....F
F. Spike narrow, 5–8 mm. in diameter.....*7. S. dubium*
FF. Spike wider, 10–15 mm. in diameter.....*19. S. texanum*
DD. Perianth-segments distinctly dentate or scarious-margined.....E

E. Leaves narrow, 0.5–2.5 mm. wide....F
F. Flowers crowded on the axis; capsules 10–12 mm. long..*15. S. Pringlei*
FF. Flowers distantly disposed on the axis; capsules 8–10 mm. long....
....*17. S. tenue*
G. Spikes 4–10 cm. long, 10 mm. in diameter....*17. S. tenue*
GG. Spikes 1.5–6 cm. long, 13–14 mm. in diameter....*5. S. Coulteri*
EE. Leaves broader, 2–8 mm. wide....F
F. Scape 85–150 cm. long....G
G. Spike 30–40 cm. long....*9. S. jaliscense*
GG. Spike 14–23 cm. long....*12. S. Mortonii*
FF. Scape 25–75 cm. long....G
G. Flowers all uniform in size and disposition on the axis....H
H. Filaments scarcely projecting beyond the perianth; capsules numerous, 5–7 mm. in diameter, closely imbricated and appressed to the axis....*13. S. obtusum*
HH. Filaments twice the length of the perianth-segments; capsules few, 4–5 mm. in diameter, small and distantly placed on the axis, not imbricated or appressed to the axis....*16. S. regulare*
GG. Flowers of different sizes and irregularly disposed on the axis....H
H. Fruit reflexed....*1. S. calcicola*
HH. Fruit not reflexed....I
I. Leaf 3–6 mm. broad; scape 40–60 cm. long; flowers subsessile
....*11. S. megarhiza*
II. Leaf 2–3 mm. broad; scape 30–45 cm. long; flowers pedicelled
....*10. S. macrocarpum*

1. Schoenocaulon calcicola Greenm. in Proc. Am. Acad. **43**: 19. 1907.

Bulb ovoid, 1.5–3 cm. in diameter; basal portion of the plant covered with coarse black fibers extending to a height of 5–14 cm.; leaves thin, 3–10 dm. long, 2–4 mm. broad; scape 5.5–7.5 dm. long, slender, somewhat flexuous, purplish toward the base; spike 8–23 cm. long, 8–10 mm. in diameter, the flowers loosely and irregularly disposed on the axis, small, sessile, short-pedicelled; perianth-segments slender, 2.5–3 mm. long, bearing a single tooth on each margin; filaments twice the length of the perianth; capsule oblong-lanceolate, 8–10 mm. long, 5 mm. in diameter, reflexed; 2–3 seeds in each cell.

MEXICO—OAXACA: Las Sedas, calcareous banks, alt. 1830 m., 19 July 1897, *Pringle 6740* (G, M, NY, PA, UC, US); hillsides, alt. 1830 m., 1 Aug. 1894, *Pringle 5754* (G TYPE, US).

2. Schoenocaulon caricifolium (Schlecht.) Gray in Hook. & Arn. Bot. Beechey's Voy. 388. 1840; Wats. in Proc. Am. Acad. **14**: 281. 1879, excluding *Coulter 1568;* Hemsl. in Salvin & Godman, Biol. Cent.-Am. Bot. **3**: 383. 1885 in part; Greenm. in Proc. Am. Acad. **43**: 19. 1907, excluding *Conzatti & Gonzalez 323.*

Veratrum caricifolium Schlecht. in Ind. Sem. Hort. Hal. 8. 1838; in Linnaea Litt. Ber. **13**: 100. 1839.

Asagraea caricifolia Kunth, Enum. Pl. **4**: 666. 1843.

Sabadilla caricifolia Schlecht. in Linnaea **18**: 444. 1844.

Bulb 15–25 mm. in diameter; base of the plant covered for 7–17 cm. with dark brown, stiff fibers; leaves narrow, flexuous, 3–3.5 dm. long, 1–3 mm. broad; scape stout, short, 15–17 cm. long; spike short and narrow, 4–6 cm. long, 10 mm. in diameter; flowers small and crowded on the axis; perianth-segments obscurely subdentate, oblanceolate, 3 mm. long; capsule broadly ovate, inflated, 15 mm. long, 10 mm. in diameter, compacted into a fruiting spike 3.5 cm. in diameter; seed 6–7 mm. long, 1–3 in each cell.

MEXICO—COAHUILA: "mountain borders," near Saltillo, 25 June 1848, *Gregg 214* (G, M). HIDALGO: near los Baños de Atotonilco el Grande, calcareous mountains, Oct. and Dec., *Ehrenberg* (G TYPE, NY, P). OAXACA: near City of Oaxaca, 16–21 June 1899, *Rose & Hough 4972* (US); Cerro Verde, Aug. 1908, *Purpus 4389* (UC).

3. Schoenocaulon comatum Brinker, n. sp.[30]

Bulb ovoid, 1.5–3 cm. in diameter; base of the plant covered for 8–26 cm. with a thick cylinder of blackish, coarse, stiff fibers; leaves longer than the scape, straight, as much as 6 dm. long and 2–4 mm. broad; scape 18–30 cm. long, erect, purplish toward the base; spike loosely flowered, attenuate, 3.5–15 cm. long, 7–12 mm. in diameter at anthesis; flowers small, subsessile; perianth-segments entire-margined, 2–3 mm. long, ligulate; filaments thin, twice as long as the perianth; mature capsule ovate-oblong, chartaceous, erect, inflated, 10–13 mm. long, 6–7 mm. in diameter; pedicel of the fruit 3–4 mm. long; 2–3 seeds in each cell.

MEXICO—SAN LUIS POTOSI: Valley of San Louis Potosi, San Miguelito Mts., coll. of 1876–1878, *Schaffner 536* (PA, G, NY); without definite locality, *Schaffner 228* (CA, NY TYPE, P, PA, UC, US); region of San Luis Potosi, alt. 1830–2440 m., coll. of 1878, *Parry & Palmer 882* (G, M, PA, US); Charcas, July-Aug. 1934, *Whiting 523* (D, NY, US). PUEBLA: Cerro de Mazize, moist soil, July 1907, *Purpus 2731* (UC); vicinity of San Luis Tultitlanapa, June 1908, *Purpus 2731* (G, NY, M, US). OAXACA: Canada de San Gabriel, Etla, alt. 300 m., 8 Aug. 1897, *Conzatti & Gonzalez 323* (G).

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[30] **Schoenocaulon comatum** sp. nov. Bulbus ovoideus, 1.5–3 cm. diametro; caudice cylindro, 7–26 cm. longo, fibris nigrescentibus crassis rigidis dense obtecto; foliis scapo longioribus, rectis, usque ad 6 dm. longis, 2–4 mm. latis; scapo 18–30 cm. longo, erecto, basin versus purpureo; spica laxiflora, attenuata, 3.5–15 cm. longa, anthesi 7–12 mm. diametro; floribus parvis, subsessilibus; perianthii segmentis integris, 2–3 mm. longis, ligulatis; filamentis tenuibus, perianthio duplo longioribus; capsulis maturis ovato-oblongis, chartaceis, erectis, inflatis, 10–13 mm. longis, 6–7 mm. diametro; pedicello fructus 3–4 mm. longo; seminibus in loculo 2–3.

4. Schoenocaulon Conzattii Brinker, n. sp.[31]

Bulb ovoid, 1.5–2 cm. in diameter; base of the plant covered for 7–23 cm. with a dense sheath of dark brown, coarse fibers; leaves 6–11 dm. long, 4–7 mm. broad; scape 5–7 dm. long; spike 10–25 cm. long, 15–17 mm. in diameter; mature flowers loosely disposed, erect, shortly pedicelled; perianth-segments with a single tooth on each margin, linear-lanceolate, 3.5–4 mm. long; filaments twice or three times as long as the perianth; immature capsule 8 mm. long, 4 mm. wide, imbricated, pedicel arched and 3–4 mm. long; 4–5 seeds in each cell.

MEXICO—HIDALGO: Sierra de Pachuca, alt. 2981 m., 1 Sept. 1906, *Pringle 13841* (G, US). STATE OF MEXICO: Temascaltepec, Rincon del Carmen, woods, alt. 1340 m., 23 Nov. 1932, *Hinton 2690* (NY); Nanchititla, oak woods, 8 Oct. 1933, *Hinton 4970* (G, M, NY). OAXACA: Cerro de San Felipe, alt. 2000 m., 29 Aug. 1897, *Conzatti & Gonzalez, 449* (G, US TYPE). PUEBLA: Boca del Monte, moist grassy soil, June 1907, *Purpus 2490* (UC).

5. Schoenocaulon Coulteri Baker in Jour. Linn. Soc. Bot. **17**: 477. 1879; Hemsl. in Salvin & Godman, Biol. Cent.-Am. Bot. **3**: 382. 1885; Coulter in Contr. U.S. Nat. Herb. **2**: 440. 1894 (Bot. West. Texas), as to name only.

Sabadilla Coulteri Kuntze, Rev. Gen. Pl. **2**: 713. 1891.

The only specimen available for examination comprises fragments of leaf tips and parts of flowering stalks. The spikes measure 1.5–6 cm. in length and 13–14 mm. in diameter; the flowers are erect, somewhat loosely set on the axis of the inflorescence; perianth-segments leathery, with a single tooth on each margin, 3 mm. long; filaments reflexed, twice the length of the perianth, anthers small, globular.

MEXICO—HIDALGO: near Zimapan, *Coulter 1569* (G ISOTYPE).

6. Schoenocaulon Drummondii Gray in Hook. & Arn. Bot. Beechey's Voy. 388. 1840; Torrey in Bot. U.S. & Mex. Bound. Surv. **2**: 222. 1859, in part, excluding Pl. Lindh.; Wats. in Proc. Am. Acad. **14**: 281. 1879; Baker in Jour. Linn. Soc. Bot. **17**: 477. 1879, in part, excluding *Lindheimer 543, 711;* Wats. in Proc. Am. Acad. **18**: 166.

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[31] **Schoenocaulon Conzattii** sp. nov. Bulbus ovoideus, 1.5–2 cm. diametro; caule fibris densis atrobrunneis crassis ad 7–23 cm. dense obtecto; foliis 6–11 dm. longis, 4–7 mm. latis; scapo 5–7 dm. longo; spica 10–25 cm. longa, 15–17 mm. diametro; floribus maturis laxe dispositis, erectis, breviter pedicellatis; perianthii segmentis utraque margine dente unico, lineari-lanceolatis, 3.5–4 mm. longis; filamentis duplo vel triplo perianthio longioribus; capsulis immaturis 8 mm. longis, 4 mm. latis, imbricatis, pedicello arcuato, 3–4 mm. longo; seminibus in cellulo 4–5.

1883, in part, as to *Palmer 1322* only; Hemsley in Salvin & Godman, Biol. Cent.-Am. Bot. **3**: 382. 1885 in part, as to name only; Small, Fl. Southeast. U.S. 250. 1903.

Schoenocaulon aletroides Gray in Hook. & Arn. Bot. Beechey's Voy. 388. 1840.

Sabadilla Drummondii Kuntze, Rev. Gen. Pl. **2**: 713. 1891.

Bulb ovoid, 2–3.5 cm. in diameter; base of the plant covered with thin scales and few fibers for 5–12 cm.; leaves 2–5 dm. long, 1.5–5 mm. broad; scape 2.5–6 dm. long; spike dense, 3–20 cm. long, 15–20 mm. in diameter; flowers subsessile; perianth-segments oblong-ovate, 3 mm. long, 1 mm. broad, nearly membranaceous, with broad scarious, erose margins; filaments stout, subclavate-filiform, much dilated above, 5–7 mm. long; flowering in autumn.

Distribution: southwestern United States and Mexico.

UNITED STATES:

TEXAS—BEE CO.: ½ mi. s. of Tuleta, 21 Sept. 1936, *Cory 20644* (G). BEXAR CO.: San Antonio, Oct. 1837, *Riddell* (US). COLORADO CO.: 3 mi. e. of Alleyton, sandy soil, 22 Sept. 1913, *Pennell 5557* (NY). DE WITT CO.: roadside near Yorktown, 6 Oct. 1857, *Schott* (NY). DUVAL CO.: 25.6 mi. n.w. of San Diego, 9 Oct. 1935, *Cory 16146* (G). GOLIAD CO.: near Goliad, open prairie, 7 Oct. 1926, *Williams 91* (PA). GUADALUPE CO.: Seguin, limestone soil, 22 Aug. 1903, *Groth 202* (CA, G, NY, US). SAN PATRICIO CO.: s. of Mathis, 20 Oct. 1927, *Rose & Russell 24160* (US). WILSON CO.: Sutherland Springs, Aug. 1879, *Palmer 1322* (G). WITHOUT DEFINITE LOCALITY: coll. of 1880, *Palmer 1322* (US); Valley of the Rio Grande, below Donana, *Parry, Bigelow, Wright & Schott 1482* (US); *Drummond I 284* (G); *Drummond III 284* (NY TYPE); 1 Oct. 1935, *Parks* (G); 1840, *Riddell 52* (NY); 188–, *Schlottmann* (US).

MEXICO—SAN LUIS POTOSI: San Dieguito, 13–16 June 1904, *Palmer 119* (G, M, NY, US); Tamazunchale, Cerro de S. Francisco, 11 May 1891, *Manry 6257* (G).

7. Schoenocaulon dubium (Michx.) Small, Flora Southeast. U.S. 250. 1903, and ed. 2, 1913; Small, Man. Southeast. Fl. 277. 1933.

Helonias dubia Michx., Fl. Bor. Am. **1**: 213. 1803; Willd. in Ges. Naturf. Freunde Berlin Mag. **2**: 29. 1808; Poiret in Lamarck, Encycl. Meth. Bot. Suppl. **3**: 28. 1813; Pursh, Fl. Am. Sept. **1**: 244. 1814; Nutt. Gen. N. Am. Pl. **1**: 234. 1818; Roem. & Schult. Syst. **7**: 1565. 1830.

Schoenocaulon gracile Gray in Ann. Lyc. N.Y. **4**: 127. 1837, and in Hook. & Arn. Bot. Beechey's Voy. 388. 1840; Kunth, Enum. Pl. **4**: 185. 1843; Chapman, Fl. South. U.S. 490. 1860; Wats. in Proc. Am. Acad. **14**: 280. 1879; Baker in Jour. Linn. Soc. Bot. **17**: 477. 1879.

Sabadilla dubia Kuntze, Rev. Gen. Pl. **2**: 713. 1891.

Bulb ovoid, small, 1.5–3 cm. in diameter; base of the plant covered for 4–13 cm. with scarious brown scales, separating above into fibers; leaves linear, narrow, suberect, 3–9 dm. long, 1–3 mm. broad;

scape very thin, 3–7 dm. high; spike slender, 10–35 cm. long, 5–8 mm. in diameter, virgate, flowers interruptedly and loosely arranged on the axis, pale green, very small, sessile; perianth-segments oblong, leathery, obscurely or not at all dentate, less than 2.5 mm. long; filaments filiform, very slender, twice the length of the perianth; capsule conic, ovate, nearly sessile, 8–10 mm. long, 5 mm. in diameter, appressed to the axis; seeds 5 mm. or less long, 2–5 in each cell.

Distribution: UNITED STATES.

FLORIDA—ALACHUA CO.: Gainesville, 3 May 1897, *Lighthipe 479* (M, NY, US), March 1876, *Garber* (NY), June 1876, *Garber* (US), open pine land, 15 June 1910, *Hood* (M, 850094), 30 April 1936, and 10 July 1936, *Murrill* (M). BREVARD CO.: Indian River, 1897, *Crawford* (PA); Eau Gallie, dry pine barrens, July 1896, *Curtiss 6551* (G, NY, M, US); Okeechobee Region, scrub-oak land, 10 July 1903, *Fredholm 6032* (G, NY); Mosquito Lagoon, dry pine barrens, June 1879, *Curtiss 2900* (G, M, NY, UC, US). HERNANDO CO.: Brooksville, moist woods, 26 April 1930, *Moldenke 5943* (NY). LAKE CO.: Okahumpka, 3 March 1888, *Burk* (PA); Eustis, June and July 1894, *Hitchcock* (M 210134), June and July 1898, *Hitchcock* (M 210138), *Marsh* (M 760846), high pine land, 1–15 April 1898, *Nash 297* (G, M, NY, UC, US), 16–31 July 1894, *Nash 1447* (PA, US), and 19–30 June 1895, *2016* (NY, US). MARION CO.: east of Flemington, dry sandy woods, 29 April 1930, *Moldenke 1087* (M, NY, US). ORANGE CO.: Lake Brantley, 12 July 1890, *Kline* (PA 517892); Aug. 1894, *Kline* (PA 517891); 7 July 1894, *Lewton* (NY), and 18 July 1894, (PA 517890); Aug. 1894, *ex Herb. Williamson* (PA 509795); Lake Conway, 11 April 1900, *Huger 13* (M); dry pine barren, 12 July 1902, *Fredholm 5387* (G, NY); Lake Helen, pine land, 24 April 1911, *Hood* (M 1073119). OSCEOLA CO.: Lake Gentry, 26 April 1925, *Howell 1105* (US). PASCO CO.: St. Joseph, dry pine lands, 24 April 1927, *O'Neill* (M 953079). POLK CO.: vicinity of Winter Haven, high pine land east of Lake Marion, 12 May 1931, *McFarlin 5261* (CA). VOLUSIA CO.: near Volusia, dry pine ridges, 24 March 1882, *Mohr* (US), dry sandy ridges, 4 April 1882, *Mohr* (US); Seville, dry pine barrens, 7 May 1900, *Curtiss 6606* (G, M, NY, PA, UC, US); De Land, March 1891, *Hulst* (NY), 25 March 1891, *Hulst* [*Hurst*] (UC), 27 March 1891, *Hulst* (NY). FORT KING AND EASTERN FLORIDA: April and May, *Leavenworth* (NY). TAMPA BAY: *Leavenworth* (G); *Alden* (NY); 1834, *Burrows* (NY). LOCALITY INDEFINITE: 1839, Buckley (G, M, NY); *Chapman* (M 210141, US 968641); *Wright* (D 88718, NY).

8. Schoenocaulon Ghiesbreghtii Greenm. in Proc. Am. Acad. **43**: 20. 1907.

Bulb 1–1.5 cm. in diameter; basal portion of the plant covered with brownish-black scales and fibers to a height of 10–12 cm.; leaves narrow, 4–8 dm. long, 2–6 mm. broad; scape straight, 5–6.5 dm. long; spike 1–2.5 dm. long, 1.5–2 cm. in diameter; bract broadly ovate, 2.5 mm. long, obtuse, 5-nerved; flowers sessile or on short pedicels; segments of the perianth oblong, glandular, with two teeth on each margin, 4–4.5 mm. long, 1 mm. broad; filaments more than twice the length of the segments; fruit unknown.

MEXICO—CHIAPAS: *Ghiesbreght 672* (G TYPE, M), and at alt. 2135 m., *Berendt* (G).

9. Schoenocaulon jaliscense Greenm. in Proc. Amer. Acad. **43**: 20. 1907.

Bulb oblong-ovoid, 2.5–3.5 cm. in diameter; basal portion of the plant covered with densely massed, tangled, fine, brownish fibers to a height of 14–16 cm.; leaves 6–10 dm. long, 2–7 mm. broad; scape 10–15 dm. long; spike 3–4 dm. long, 12 mm. in diameter; flowers small, shortly pedicelled, irregularly spaced on the axis; perianth-segments linear, with a single tooth on each margin; filaments reddish-purple, twice the length of the perianth; capsule ovate, 6 mm. long, 3 mm. in diameter, on curved pedicel and appressed to the axis.

MEXICO—JALISCO: near Guadalajara, cool grassy sides of canyons, *Pringle 2938* (G TYPE); same locality, steep bluffs of ravines, *Pringle 11853* (G, US).

10. Schoenocaulon macrocarpum Brinker, n. sp.[32]

Bulb ovoid, 2.5–3 cm. in diameter; base of the plant covered for 12–14 cm. with coarse black fibers; leaves about 5 dm. long, 2–3 mm. broad; scape 3–4.5 dm. long; spike 10–23 cm. long, about 8 mm. in diameter; flowers small, subsessile, erect, not very closely placed on the axis; perianth-segments ligulate, linear, with a single tooth on each margin; filaments reddish, twice the length of the perianth-segments; capsule linear-oblong, imbricated, appressed to the axis of the inflorescence, 16 mm. long, 4 mm. in diameter; 1–3 seeds in each cell.

MEXICO—NUEVO LEON: Sierra Madre Oriental, Canyon de los Charcos y Mesa de la Camisa, above Alamar, 15 mi. s.w. of Galeana, common in open wood in lower canyon, 4 June 1934, *Mueller 724* (G TYPE, F).

11. Schoenocaulon megarhiza Jones, Contr. West. Bot. 14: 29. 1912 (as *megarrhiza*).

Bulb 2.5–3.5 cm. in diameter; basal portion of the plant covered for 10–14 cm. with coarse, brownish-black fibers; leaves 3–7 dm. long, 3–6 mm. wide; scape 4–6 dm. long; spike 2–3 dm. long, 10–12 mm. in diameter; flowers small, sessile to subsessile; perianth-segments 3 mm. long, with a single tooth on each margin; filaments not much longer than the perianth; immature capsule 6 mm. long, 3 mm. in diameter, on a pedicel 3 mm. long; 3–4 seeds in each cell.

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[32] **Schoenocaulon macrocarpum** sp. nov. Bulbus ovoideus, 2.5–3 cm. diametro; caule fibris crassis nigrisque ad 12–14 cm. obtecto; foliis circa 5 dm. longis, 2–3 mm. latis; scapo 3–4.5 dm. longo; spica 10–23 cm. longa, circa 8 mm. diametro; floribus parvis, subsessilibus, erectis, haud arcte dispositis; perianthii segmentis ligulatis, linearibus, utraque margine dente uno; filamentis rubris, perianthii segmentis duplo longioribus; capsulis lineari-oblongis, imbricatis, axi appressis, 16 mm. longis, 4 mm. diametro; seminibus in loculo 1–3.

MEXICO—CHIHUAHUA: Sierra Madre Mts., Guayanopa Canyon, alt. 1525 m., 23 Sept. 1903, *Jones* (P TYPE); transition pine slopes, Sierra Charuco, Rio Fuerte, infrequently scattered along shady banks and under trees, 23 July 1936, *Gentry 2315* (G, M); transition, pine-oak country, solitary in shaded rock outcroppings, Sierra Canelo, Rio Mayo, 30 Aug. 1936, *Gentry 2515* (G, M, UC); San Jose de Pinal, Rio Mayo, transition, pine slopes, in rocky terrain with harsh grass, 5 Sept. 1936, *Gentry 2591* (M). SINALOA: Quebrado de Mansana, Sierra Surotato, open grassy slope, oak forest, alt. 1200–1350 m., 10–14 Sept. 1941, *Gentry 6555* (M).

12. Schoenocaulon Mortonii Brinker, n. sp.[33]

Bulb unknown; leaves 6–7 dm. long, 3–5 mm. broad; scape erect, very long, 8.5–10 dm. long; spike many-flowered, 14–23 cm. long, 10–12 mm. in diameter; flowers sessile or on short pedicels, loosely disposed on the axis of the inflorescence; perianth-segments with a single wide tooth on each margin, 3 mm. long; filaments reddish-purple, twice as long as the perianth; capsule unknown.

MEXICO—MICHOACAN: Zitacuaro, Ypasote Hill, alt. 2175 m., steep rocky slope in sparse oak forest, 18 Nov. 1938, *Hinton 13465* (M TYPE, G).

13. Schoenocaulon obtusum Brinker, n. sp.[34]

Bulb ovoid, 2–3 cm. in diameter; base of the plant sheathed for 10–20 cm. by a dense cylindrical growth of brown, coarse, rigid fibers; leaves about 5 dm. long, 3–8 mm. broad; scape 25–45 cm. long; spike dense, regular, 8–20 cm. long, 8–10 mm. in diameter; all the flowers maturing simultaneously and of the same disposition on the axis, touching each other, sessile; perianth-segments short, 3 mm. long, obtuse, with a single tooth on each margin; filaments scarcely longer than the perianth; capsules numerous, imbricated and appressed to the axis of the inflorescence, 8–10 mm. long, 5–7 mm. in diameter, 1–3 seeds in each cell.

MEXICO—HIDALGO: Sierra de Pachucha, Sept. 1903, *Rose & Painter 6722* (G, US TYPE); El Chico, "Entre Roca Lumate," July 1929, *Lyonnet 329* (M, NY, US).

14. Schoenocaulon officinale (Schlecht. & Cham.) Gray in Hook. & Arn. Bot. Beechey's Voy. 388. 1840; Benth. Pl. Hartw. 29. 1840;

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[33] **Schoenocaulon Mortonii** sp. nov. Bulbus ignotus; foliis 6–7 dm. longis, 3–5 mm. latis; scapo erecto, perlongo, 8.5–10 dm.; spica multiflora, 14–23 cm. longa, anthesi 10–12 mm. diametro; floribus sessilibus vel breviter pedicellatis, laxe dispositis; perianthii segmentis utraque margine dente lato uno, 3 mm. longis; filamentis rubro-purpureis perianthio duplo longioribus; capsulis ignotis.

[34] **Schoenocaulon obtusum** sp. nov. Bulbus ovoideus, 2–3 cm. diametro; caudice cylindro ad 10–20 cm. fibris brunneis crassis rigidis dense obtecto; foliis circa 5 dm. longis, 3–8 mm. latis; scapo 25–45 cm. longo; spica densa, regularis, 8–20 cm. longa, 8–10 mm. diametro; floribus omnibus aequalibus maturitate et dispositione, mutuis tangentibus, sessilibus; perianthii segmentis brevibus, 3 mm. longis, obtusis, utraque margine dente uno; filamentis perianthio haud longioribus; capsulis numerosis, imbricatis et inflorescentiae axi appressis, 8–10 mm. longis, 5–7 mm. diametro; seminibus in loculo 1–3.

loc. cit. 96. 1842; Wats. in Proc. Am. Acad. **14**: 281. 1879; Baker in Jour. Linn. Soc. Bot. **17**: 476. 1879; Hemsl. in Salvin & Godman, Biol. Cent.-Am. Bot. **3**: 383. 1885, in part; Yuncker in Field Mus. Publ. Bot. **17**: 323. 1938.

Veratrum officinale Schlecht. & Cham. in Linnaea **6**: 45. 1831; Nees, Pl. Offic. *pl. 50*. 1821–33.

Helonias officinalis Don in Edinb. N. Phil. Jour. 234. 1832; Lindley, Fl. Med. 586. 1838.

Sabadilla officinarum Brandt (Brandt & Ratzeburg) in Hayne, Arzneig. **13**: *pl. 27*. 1836 [1837]; Schlecht. in Linnaea **18**: 444. 1844; Kuntze, Rev. Gen. Pl. **2**: 713. 1891, as *officinalis;* Standl. & Cald. in List. Prelim. Pl. El Salvador, 49. 1925, as *officinalis;* Knuth in Fedde Rep. Beih. **43**: 199. 1927, in part.

Asagraea officinalis Lindl. in Edwards' Bot. Reg. n.s. **2**: *pl. 33*. 1839; Hook & Arn. Bot. Beechey's Voy. 388. 1840; Kunth, Enum. Pl. **4**: 184, 1843; Spach in Hist. Nat. Veg. Phan. **12**: 245. 1846; Lindl. Med. & Oecon. Bot. 55, *fig. 90*. 1849; Hare, Caspari & Rusby, Nat. Stand. Dispens. 1336, *fig. 354*. 1905.

Asagraea caracasana Ernst in Jour. Bot. **9**: 91. 1871; Hemsl. in Salvin & Godman, Biol. Cent.-Am. Bot. **3**: 383. 1885, in synonomy

Bulb large and thick, 2.5–4 cm. in diameter; base of the plant covered for 8–20 cm. with dark brown scales separating above into fibers; leaves coarse, 3–10 dm. long, 3–15 mm. broad; scape angled below, terete above, 6–12 dm. long, 3–12 mm. in diameter; flowering spike dense, cylindrical, 1–5.5 dm. long, 12–18 mm. in diameter; perianth-segments ligulate, narrowly oblong lanceolate, 3–4 mm. long, margins entire, nectaries prominent at the base of the segment; filament thick, stout, 6–7 mm. long; fruiting spike 2 cm. in diameter; capsules numerous, crowded, elliptic-oblong, 10–13 mm. long, 4–5 mm. in diameter, on pedicels 4 mm. long; bracts deltoid, 3 mm. long; seeds 1–4 in each cell.

Distribution: Mexico, Central America to Venezuela and Peru.

NORTH AMERICA:

MEXICO—CHIAPAS: Fenia, open pine and oak forest, June 1925, *Purpus 405* (US); Siltepec, 9 Aug. 1937, *Matuda 1600* (F, NY). COLIMA: 9 Jan.–6 Feb. 1891, *Palmer 1410* (G, US). MEXICO STATE: Temascaltepec, Telpincla, alt. 1840 m., 17 Nov. 1932, *Hinton 2420* (CA); Temascaltepec, Chorrera, alt. 1230 m., 9 Oct. 1932, *Hinton 2039* (G, F). MICHOACAN: Zitacuaro, Piedra de Cal, alt. 1300 m., steep rocky slope, 10 Sept. 1938, *Hinton 13226* (G, M, NY, US). MORELOS: Hochicalco, on sunny heights, 29 Sept. 1910, *Seler 5379 (296)* (G). GUERRERO: Mina, Santa Teresa, grassy hill, oak woods, alt. 1040 m., 12 Sept. 1936, *Hinton 9397* (US); Mina, Puerto del Clarin Cayunche, grassy hill, alt. 750 m., 21 Sept. 1936, *Hinton 9506* (US); Mina, Calavera, Puerto, oak woods, 19 Sept. 1936, *Hinton 9539* (G, NY, US). OAXACA: Santa Efigenia, alt. 150 m., 18 July 1895,

Nelson 2847 (US), and *2849* (F); San Benito, near Apango, alt. 500 m., 11 Oct. 1917, *Reko 3475* (US). VERA CRUZ: Orizaba, June 1857, *Mohr & Botteri* (US), *Botteri 1186* (G, US); Borrego, 1866, *Bourgeau 2981* (G, US), 7 Oct. 1853, *Mueller 222* (G, NY), Uluapam, Oct. 1853, *Mueller 231* (NY), Consoquitla, 1841-43, *Liebmann 14625* (F), Mirador, Oct. 1841, *Liebmann 14627* (F), Aug. 1841, *14628* (G, F, UC, US), and *14629* (F); Maltrata, May 1937, *Matuda 1346* (F, NY); Zacuapan, Fortin, sunny slopes, open woods, Aug. 1906, *Purpus 2023* (F, G, M, NY, UC, US); Cerro de Borego, dry calcareous hills, *collector unknown, 496* (PA). "On the eastern slopes of the Mexican Andes," in the Barranca de Tioselo near the Hacienda de la Laguna, *Schiede & Deppe 982* (M TYPE).

A specimen in the Gray Herbarium labeled "Mexico (Hooker dupl. 1839)" without further data is referable to this species.

CENTRAL AMERICA:

GUATEMALA—DEPT. SANTA ROSA: Rio de Los Esclavos, alt. 750 m., Aug. 1892, *Heyde & Luz (Smith 3874)* (G, NY, US); Alameda, 8 Aug. 1937, *Johnston 961* (F, NY). DEPT. HUEHUETENANGO: Uaxackanal, Quen Santo, open wooded limestone hills, 23 Aug. 1896, *Seler 3220* (G); Chaguial, open wooded limestone hills, 7 Sept. 1896, *Seler 3273* (G, US). DEPT. GUATEMALA: 10 km. s. of San Raimundo, damp wooded barranca, bushy slope, alt. 1800 m., 18 Jan. 1939, *Standley 62922* (F); 1939, *Aguilar 128* (F). DEPT. ZACAPA: lower slopes of Sierra de las Minas, along trail above Rio Hondo, 250–900 m. alt., grassy area, 11 Oct. 1939, *Steyermark 29548* (F). DEPT. CHIQUIMULA: Montana Castilla, vicinity of Montana Cebollas, along Rio Lucia Saso, 3 mi. s.e. of Quezaltepeque, alt. 1200–1500 m., 6 Nov. 1939, *Steyermark 31227* (F). DEPT. JUTIAPA: Lago Retana, between Overo and Progresso, alt. 600 m., 26 Nov. 1939, *Steyermark 32025* (F). WITHOUT DEFINITE LOCALITY: in rocky places, 1840, *Hartweg 627* (NY).

HONDURAS—DEPT. OF COMAYAGUA: 6 km. w. of Siguatepeque, moist soil, river bank, alt. 1250 m., 8 Aug. 1936, *Yuncker, Dawson & Youse 6358* (F, G, M).

EL SALVADOR—Vicinity of San Salvador, *Renson 167* (NY, US); Cerro de San Jacinto, Aug. 1922, *Calderon 1060* (G, M, NY, US).

COSTA RICA—ALAJUELA: San Jose, Nuestro Amo, alt. 800 m., July 1912, *Jimenez 637* (US).

SOUTH AMERICA:

VENEZUELA—CARACAS: Sept. 1929, *Elias 71* (F); grassy hills, *Ernst* (US 601444); 24 June 1917, *Curran & Haman 1196* (CA, F, G, NY, UC, US); mountain sides, alt. 600–1050 m., Dec. 1935, *Lawrance 888* (NY); Middle Catouche wood, in forest, in savannas, alt. 1200–1400 m., 2 Sept. 1917, *Pittier 7352* (G, US); La Guaira, old road, alt. 1100–1300 m., 6 June 1921, *Pittier 9556* (G, US); 31 Oct. 1916, *Rose 21887* (NY, US); Los Chorros, alt. 950 m., Dec. 1939, *Williams 13604* (F); between Caracas and La Guaira, through Brett, *Rose 21887* (US). TOVAR: 1854–5, *Fendler 1506* (G, M). MIRANDA: hills above Los Teques, in open places, 7 Sept. 1924, *Pittier 11611* (NY, US); Los Chorros, alt. 960 m., 20 Nov. 1939, *Williams 12398* (F). LOCALITY UNSPECIFIED: 22 Sept. 1891, *Eggers 13361* (F, US).

PERU—San Miguel, Urubama valley, alt. 1800 m., 31 May 1915, *Cook & Gilbert 1013* (US); Santa Ana, alt. 900 m., 27 June 1915, *Cook & Gilbert 1538* (US). CUZCO: POTRERO, Convencion, alt. 1300 m., 4 March 1940, *Vasgare 1844* (G).

15. Schoenocaulon Pringlei Greenm. in Proc. Am. Acad. **32**: 295. 1897.

Bulb ovoid, 1.5–3 cm. in diameter; base of the plant covered with coarse dark brown fibers to the height of 8–24 cm.; leaves narrow, 2.5–7 dm. long, 1–3 mm. broad; scape straight, 3–7.5 dm. long; flowering spike 2–10 cm. long, 8–10 mm. in diameter; fruiting spike

dense, 15 mm. in diameter; bract rounded at the apex; flowers closely appressed, sessile to subsessile; perianth-segments oblong-ovate, dark-brown, scarious-margined, 4–5 mm. long; filaments scarcely projecting beyond the perianth; capsules imbricated, oblong, 10–12 mm. long, 5 mm. in diameter; seeds small, thin, 4–5 mm. long, 1–5 in each cell.

MEXICO—HIDALGO: between Somoriel and Las Lajas, 5 Aug. 1905, *Rose, Painter & Rose 9243* (G, US). FEDERAL DISTRICT: lava beds, Serrania de Ajusco, alt. 3050 m., 23 Aug. 1896, *Pringle 6451* (CA, G, M, NY, PA, UC, US TYPE); Cima Station, lava fields, alt. 3050 m., 19 Sept. 1903, *Pringle 11716* (G, US), alt. 2981 m., *Pringle 13621* (G, US); La Cima de Ajusco, lava fields, alt. 2981 m., 2 Aug. 1906, *Pringle 13778* (G, US). NAYARIT: near Santa Teresa, top of Sierra Madre, 13 Aug. 1897, *Rose 2227* (US). PUEBLA: Mount Orizaba, 25–26 July 1901, *Rose & Hay 5690* (US).

16. Schoenocaulon regulare Brinker, n. sp.[35]

Bulb ovoid, 2–4 cm. in diameter; base of the plant covered for 6–14 cm. by a collar of dark-brown, coarse fibers; leaves shorter than the scape and inflorescence, 2–6 dm. long, 2–5 mm. broad; scape 2.5–6 dm. long; spike loosely flowered, tapering, 10–24 cm. long, 7–10 mm. in diameter; flowers very small, sessile, equal to each other in size and maturity, regularly disposed; perianth-segments very small, with a single tooth on each margin, 2.5 mm. or less long; filaments twice the length of the perianth; capsules subsessile, 8–12 mm. long, 4–5 mm. in diameter; 2–4 seeds in each cell.

MEXICO—JALISCO: Sierra Madre Occidental, trail from San Sebastian to Real Alto, Loma del Oregano, alt. 1500 m., pine forest on steep hill-slope, 18 Feb. 1927, *Mexia 1702* (CA, D, M, NY, UC, US TYPE); w. of San Sebastian, Hacienda del Ototal, Arroyo de los Hormos, alt. 1500 m., near stream, 6 March 1927, *Mexia 1823a* (CA, UC, US); Sierra Madre, w. of Polanos, 15–17 Sept. 1897, *Rose 2987* (G, US). DURANGO: Santiago Papasquiaro, April–Aug. 1896, *Palmer 419* (G, M, NY, UC, US).

17. Schoenocaulon tenue Brinker, n. sp.[36]

Bulb small, 1–1.5 cm. in diameter; base of the plant covered for

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[35] **Schoenocaulon regulare** sp. nov. Bulbus ovoideus, 2–4 cm. diametro; caudice fibris atro-brunneis crassis ad 6–14 cm. dense obtecto; foliis scapo et inflorescentia brevioribus, 2–6 dm. longis, 2–5 mm. latis; scapo 2.5–6 dm. longo; spica laxiflora, attenuata, 10–24 cm. longa, 7–10 mm. diametro; floribus minimis, sessilibus, magnitudine et maturitate aequalibus, regulariter dispositis; perianthii segmentis minimis, utraque margine dente uno, 2.5 mm. vel minus longis; filamentis perianthio duplo longioribus; capsulis subsessilibus, 8–12 mm. longis, 4–5 mm. diametro; seminibus in loculo 2–4.

[36] **Schoenocaulon tenue** sp. nov. Bulbus parvus, 1–1.5 cm. diametro; caule fibris brunneis filamentosis ad 6–13 cm. alto obtecto; foliis tenuissimis, brevibus, subfiliformibus, 2.5–3.5 dm. longis, .5–2 mm. latis; scapo brevi, erecto, gracili, 16–35 cm. alto; spica 4–10 cm. longa, 10 mm. tantum diametro; floribus paucis, minimis, pedicellatis, distanter dispositis; perianthii segmentis utraque margine dente uno, ligulatis, 2.5–3 mm. longis; filamentis duplo perianthio longioribus; capsulis maturis parvis, 8–10 mm. longis, 4–5 mm. diametro; seminibus in loculo 1–2.

6–13 cm. with brown hair-like fibers; leaves very narrow, short, subfiliform, 2.5–3.5 dm. long, 0.5–2 mm. broad; scape short, erect, slender, 16–35 cm. high; spike 4–10 cm. long, only 10 mm. in diameter; flowers few, very small, pedicelled, distantly disposed on the axis of inflorescence; perianth-segments with a single tooth on each margin, ligulate, 2.5–3 mm. long; filaments twice as long as the perianth; mature capsules small, 8–10 mm. long, 4–5 mm. in diameter, 1–2 seeds in each cell.

MEXICO—MORELOS: cooler grassy slopes of the knobs of the Sierra de Tepoxtlan, alt. 2285 m., Sept.–Nov. 1900, *Pringle 8356* (G, M TYPE, NY, P, PA, UC, US). SAN LUIS POTOSI: Charcas, July–Aug. 1934, *Lundell 5464* (US).

Further collections of this plant may prove its identity with the obscure *S. Coulteri.*

18. Schoenocaulon tenuifolium (Mart. & Gal.) Robins. & Greenm. in Am. Jour. Sci. III, **50**: 168. 1895.

Veratrum tenuifolium Mart. & Gal. in Acad. Roy. Brux. Bul. **9**[2]: 380. 1842; Hemsl. in Salvin & Godman, Biol. Cent.-Am. Bot. **3**: 383. 1885.

Asagraea tenuifolia Kunth, Enum. Pl. **4**: 700. 1843; Hemsley, *l.c.*

Bulb 2.5–4.5 cm. in diameter; base of the plant covered with a sheath of very coarse fibers to the height of 15–30 cm.; leaves 5–9 dm. long, 3–10 mm. broad; scape stout, 10–36 cm. long; flowering spike 7–16 cm. long, 16–20 mm. in diameter at anthesis; subtending bract large, 4 mm. long; fruiting spike fertile at the base only, 4–5 cm. in diameter; flowers large, sessile, densely arranged on the axis; perianth-segments broadly ovate, green tipped with red, margin erose, 5 mm. long, 3 mm. broad; filaments thick, red, twice the length of the perianth; capsule large, inflated, obovate, 18–20 mm. long, 10–12 mm. in diameter; seeds large, oval, 7 mm. long, 5 mm. in diameter, 1–2 in each cell.

MEXICO—OAXACA: Cerro San Felipe, alt. 3000 m., *Conzatti 688* (G); mountains s. of Miahuatlan, alt. 300 m., *Nelson 2530a* (G, US); Sierra de San Felipe, alt. 3011 m., *Pringle 5857* (G, US), alt. 2890 m., *6653* (F, G, NY, M, PA, UC, US), and alt. 3200 m., *10184* (F, G, M, NY, PA, UC, US), alt. 300 m., *Smith 753* (M, US).

19. Schoenocaulon texanum Scheele in Linnaea **25**: 262. 1852.

Schoenocaulon Drummondii Torrey in Bot. U.S. & Mex. Bound. Surv. **2**: 222. 1859, as to Pl. Lindh. only; Wats. in Proc. Am. Acad. **14**: 281. 1879, as to synonym; Baker in Jour. Linn. Soc. Bot. **17**: 477. 1879, as to synonym and *Lindheimer 543* and *711;* Wats. in Proc. Am. Acad. **18**: 166. 1883, as to *Coulter 1570* only; Hemsl. in Salvin & Godman, Biol. Cent.-Am. Bot. **3**: 382. 1885; Small, Fl. South-

east. U.S. 250. 1903; Wooton & Standl. in Contr. U.S. Nat. Herb. **19**: 129. 1915, as to synonym.

Schoenocaulon intermedium Baker in Jour. Linn. Soc. Bot. **17**: 477. 1879, as to *Coulter 1568* and *1570*.

Bulb 1.5–2.5 cm. in diameter; basal portion of the plant covered with a dense cylinder of brownish-black fibers 7–15 cm. long; leaves narrow, recurved, 3–6 dm. long, 2–5 mm. broad; scape slender, 3–4.5 dm. long; spike pointed at the apex, densely flowered, 7.5–18 cm. long, 10–15 mm. in diameter; bracts acutish to acute, 2 mm. long; flowers erect, crowded, subsessile, pedicel less than 1 mm. long; perianth-segments linear-oblong, thickened, entire or obscurely dentate, 2 mm. long; filaments slender, slightly dilated toward the base only, 3–4 mm. long; capsules somewhat appressed to the axis of the inflorescence, 10–14 mm. long, 4–7 mm. in diameter; fruiting pedicel 2 mm. long; seeds 5–6 mm. long, 1–3 in each cell; flowering in spring.

Distribution: southwestern United States and northern Mexico.

UNITED STATES:

TEXAS—BEE CO.: Beeville, 30 March 1932, *Jones 29080* (M, P, UC). BEXAR CO.: Leon Springs, tropical life zone, 17 May 1911, *Clemens 483* (CA, M, P); nw. of San Antonio, hard limestone hillside along scenic loop, 26 April 1936, *Metz 2436* (NY); San Antonio, April 1922, *Schulz 792* (US). BREWSTER CO.: 5 mi. n. of Nichols' Ranch House, 4 April 1937, *Warnock T625* (G). COMAL CO.: New Braunfels, stony prairies, dry places, April 1846, *Lindheimer 543* (G, M, NY, PA, UC, US, all ISOTYPES), and April 1848, *711* (G, M, NY, PA); Comanche Spring, 1850, *Lindheimer 1220* (M), and May 1851, *1221* (G, M, NY, PA, UC, US). CULBERSON CO.: ridge above McKittrick Canyon, shaded rocky places, 17 July 1931, *Moore & Steyermark 3485* (CA, D, G, M, NY, PA, UC, US). GILLESPIE CO.: Nibo (†) Mt., *Jermy 329* (M, US). GOLIAD CO.: Goliad, open prairie, March 1927, *Williams 50* (PA). HAYS CO.: San Marcos, rocky uplands, 8 April 1918, *Palmer 13309* (US); San Marcos and vicinity, spring 1898, *Stanfield* (NY). JEFF DAVIS CO.: 17 mi. sw. of Toyahvale, 30 Oct. 1935, *Cory 17533* (G). KENDALL CO.: 8¾ mi. nw. of Boerne, 24 May 1935, *Cory 13988* (G); rocky bluffs, June 1885, *Reverchon 1607* (D, G, M, NY, P, US); Boerne, dry calcareous hills, 22 May 1916, *Palmer 9341* (D, M, PA, US); on limestone hill, e. of Comfort, 29 April 1940, *von Schrenk* (M). KERR CO.: Turtle Creek, 2 May 1899, *Bray 227* (US); about Kerrville, 480–600 m. alt., 12–19 June 1894, *Heller 1626* (G, M, NY, PA, UC, US); Kerrville, sandy loam of stony hill, 9–10 May 1920, *Pennell 10373* (NY, PA). TRAVIS CO.: Bull Creek, 2 May 1926, *Bogusch 546* (US); Austin, 13 May 1872, *Hall 644* (G, M, NY, P, US); near Austin, 24 April 1914, *Young* (M); *Austin*, 18 April 1903, *ex Herb. Biltmore 14799* (US). Between Kerrville, KERR CO. and San Antonio, BEXAR CO.: 23 April 1931, *Jones 78405* (M, P, UC). Between Mason, MASON CO. and Fredericksburg, GILLESPIE CO., 14 May 1932, *McKelvey 2780* (G). WITHOUT DEFINITE LOCALITY: Guadalupe Mts., w. Texas, 1882, *Havard 29* (G, PA); 1881, *Havard* (US). "Between w. Texas and El Paso, New Mexico," May–Oct. 1849, *Wright 697* (G, UC, US). Upper Guadalupe, stony prairie, April 1845, *Lindheimer 416* (G, M); mountainous prairies, May–June 1884, *Reverchon 1607* (M).

NEW MEXICO—CHAVES CO.: 10 mi. w. of Roswell, 28 July 1905, *Wooton* (US). EDDY CO.: Guadalupe Mts., e. of Queen, crevices of rocks, 19 May 1932, *Wilkins 2026* (PA, US).

MEXICO—CHIHUAHUA: Santa Eulalia Mts., May–June 1885, *Pringle 40* (G, NY, PA, US); same locality, 18 Aug. 1887, *Pringle 40* (M 207467), and coll. of 1885, *Wilkinson* (NY). HIDALGO: near Zimapan, *Coulter 1568* and *1570* (G). NUEVO LEON: Monterrey, Sierra Madre Mts., 27 July 1933, *Mueller 12* (G); foothills below Pablillo, 15 mi. sw. of Pueblo Galeana, alt. 2256–2440 m., rare in oak scrub, 21 May 1934, *Mueller 513* (G). PUEBLA: vicinity of Puebla, Hueyotlipan, alt. 2180 m., 15 June 1908, *Arsène 10227* (US); Manzanilla, 20 July 1910, *Nicolas 2302* (US); *Arsène* (US 1031247). TAMAULIPAS: vicinity of Marmolejo, Pico del Diabolo, 12 Aug. 1930, *Bartlett 10918* (US); 10 kilo. n.w. of El Progresso, which is 18 kilo. n.w. of Ocampo, on mountains with luxuriant vegetation, alt. 1450 m., 22 Aug. 1941, *Stanford, Retherford & Northcraft 1055* (M).

20. Schoenocaulon yucatanense Brinker, n. sp.[37]

Bulb unknown; leaves 6 dm. and more long, 6–7 mm. broad; scape slender, 44 cm. long; spike 11 cm. long, 15 mm. in diameter at anthesis; all flowers sessile, erect; bracts small, scarious, very erose; perianth-segments erose-margined, ovate-oblong, about 2.5 mm. long; filaments three times as long as the perianth, slightly dilated above, reflexed, yellow; capsule unknown.

MEXICO—YUCATAN: Uxmal, on base of large pyramid, 20–21 July 1932, *Steere 2093* (NY TYPE).

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[37] **Schoenocaulon yucatanense** sp. nov. Bulbus ignotus; foliis 6 dm. et ultra longis, 6–7 mm. latis; scapo gracili, 44 cm. longo; spica 11 cm. longa, anthesi 15 mm. diametro; floribus omnibus sessilibus, erectis; bracteis parvis, scariosis, valde erosis; perianthii segmentis margine erosis, ovato-oblongis, circa 2.5 mm. longis; filamentis perianthio triplo longioribus, superne sensim dilatatis, reflexis, luteis; capsulis ignotis.

EXCLUDED SPECIES

Asagraea frigida (Schlecht. & Cham.) Lyons, Pl. Names Scientif. and Pop., ed. 508. 1907 = **Stenanthium frigidum** Kunth (*Veratrum frigidum* Schlecht. & Cham.), fide Index Kewensis.

Asagraea longiflora Rusby in Bull. N. Y. Bot. Gard. **6**: 491. 1910 = **Tofieldia falcata** Pers. Syn. **1**: 399. 1805.

LIST OF EXSICCATAE

The numbers in the parentheses indicate the numbers of the species as treated in the monograph. The collector's numbers are in *italics;* the abbreviation *s.n.* signifies that the specimen is without a collector's number.

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Bartlett, H. H. *10918* (19).
Berendt, *s.n.* (8).
Biltmore (ex Herb.) *14799* (19).
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Bourgeau, E. *2981* (14).
Bray, W. L. *227* (19).
Buckley, S. B. *s.n.* (7).
Burk, I. *s.n.* (7).
Burrows, Dr., *s.n.* (7).
Calderon, S. *1060* (14).
Chapman, A. W. (ex Herb.) *s.n.* (7).
Clemens, Mr. and Mrs. J. *483* (19).

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Cook, O. F. & Gilbert, G. B. *1013, 1538* (14).
Cory, V. L. *16146, 20644* (6); *13988, 17533* (19).
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Curtiss, A. H. *2900, 6551, 6606* (7).
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Groth, B. H. A. *202* (6).
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Hartweg, T. *627* (14).
Havard, V. *s.n., 29* (19).
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Hinton, G. B. *2690, 4970* (4); *13465* (12); *2039, 2420, 9397, 9506, 9539, 13226* (14).
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Hood, S. C. *s.n.* (7).
Howell, A. H. *1105* (7).
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Hulst, G. P. *s.n.* (7).
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Mueller, C. H. & M. T. *724* (10); *12, 513* (19).
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Pringle, C. G. *5754, 6740* (1); *13841* (4); *2938* (9); *6415, 11716, 13621, 13778* (15); *8356,* (17); *5857, 6653, 10184* (18); *40* (19).
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Renson, C. *167* (14).
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Rose, J. N. & Hay, R. *5690* (15).
Rose, J. N. & Hough, W. *4972* (2).
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Rose, J. N., Painter, J. H. & Rose, J. S. *9243* (15).
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Schiede, C. J. W. & Deppe, F. *982* (14).
Schlottmann, *s.n.* (6).
Schott, A. *s.n.* (6).
Schrenk, H. von. *s.n.* (19).
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Seler, C. & E. *3220, 3273, 5379* (14).
Smith, C. L. *753* (18).
Smith, J. D. *3874* (14).
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Steere, W. C. *2093* (20).
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Vasgare, C. *1844* (14).
Warnock, B. H. *T625* (19).
Whiting, A. F. *523* (3).
Wilkins, H. *2026* (19).
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Wright, C. *697* (19).
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Young, M. S. *s.n.* (19).
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Index to Genera and Species

Accepted names are printed in Roman type; synonyms in *italics;* new names and new combinations, in **bold face** type.

EXPLANATION OF PLATE

PLATE 27

Center: Generalized flower of *Schoenocaulon*, × 4½.

Figs: A-G: Capsules.

Fig. A. *S. tenue*, × 4.

Fig. B. *S. calcicola*, × 5½, *S. regulare*, × 5½, *S. officinale*, × 5, *S. texanum*, × 5.

Fig. C. *S. Pringeli*, × 5.

Fig. D. *S. macrocarpum*, × 4½.

Fig. E. *S. tenuifolium*, × 4½.

Fig. F. *S. Conzattii*, × 4, *S. dubium*, × 4, *S. jaliscense*, × 6, *S. megarhiza*, × 6, *S. obtusum*, × 4.

Fig. G. *S. caricifolium*, × 4½, *S. comatum*, × 6.

Figs. 1-13: Perianth-segments.

Fig. 1. *S. regulare*, × 3.

Fig. 2. *S. Drummondii*, × 4.

Fig. 3. *S. officinale*, × 4.

Fig. 4. *S. yucatanense*, × 4½.

Fig. 5. *S. Pringlei*, × 4.

Fig. 6. *S. obtusum*, × 4, *S. tenue*, × 5.

Fig. 7. *S. Mortonii*, × 4½.

Fig. 8. *S. dubium*, × 4.

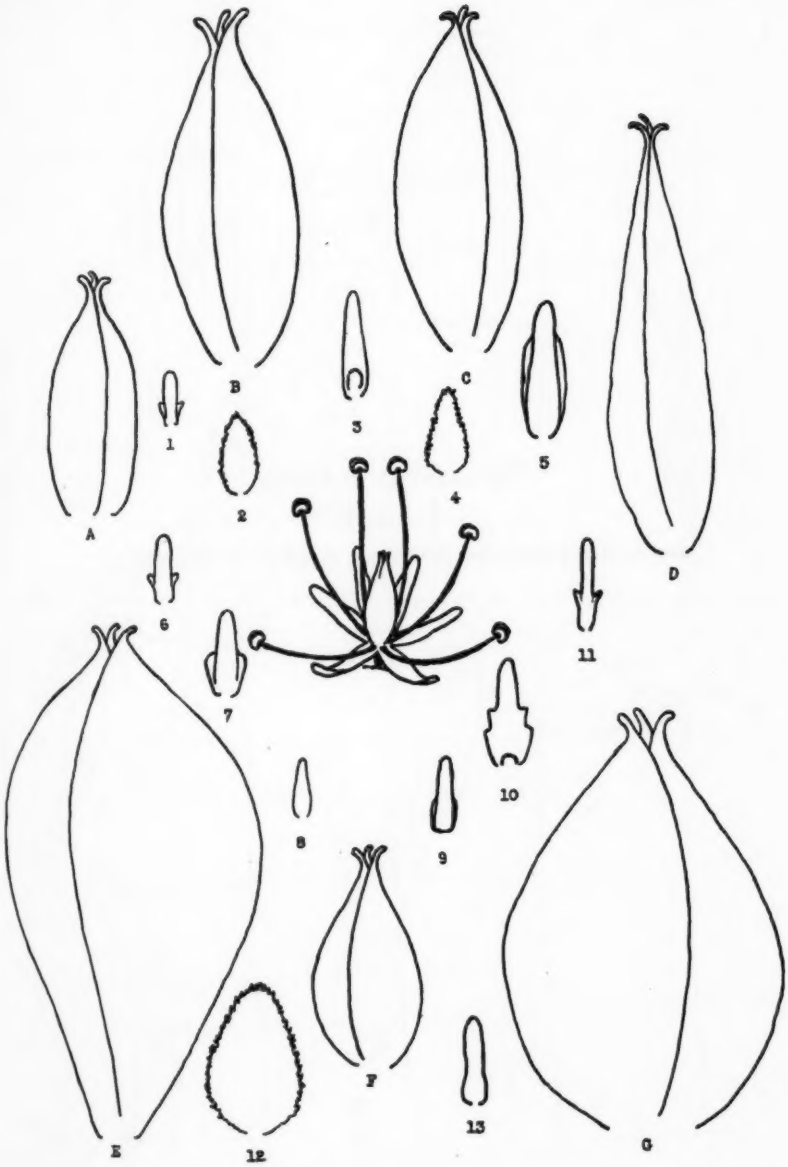
Fig. 9. *S. caricifolium*, × 4.

Fig. 10. *S. Ghiesbreghtii*, × 4.

Fig. 11. *S. macrocarpum*, × 5; *S. texanum*, × 4; *S. jaliscense*, × 5; *S. calcicola*, × 4; *S. Conzattii*, × 3; *S. megarhiza*, × 6; *S. Coulteri*, × 4.

Fig. 12. *S. tenuifolium*, × 4.

Fig. 13. *S. comatum*, × 4.

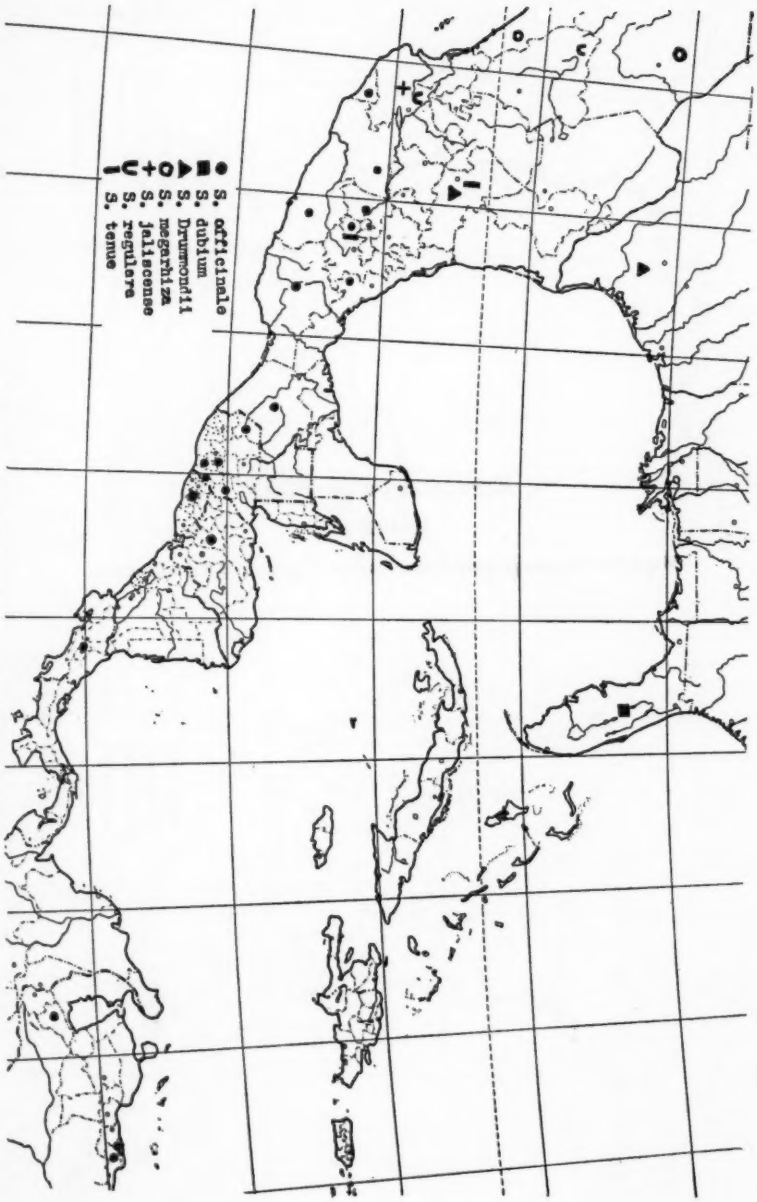


BRINKER—MONOGRAPH OF SCHOENOCAULON

EXPLANATION OF PLATE

PLATE 28

Map showing geographical distribution of species of *Schoenocaulon*.

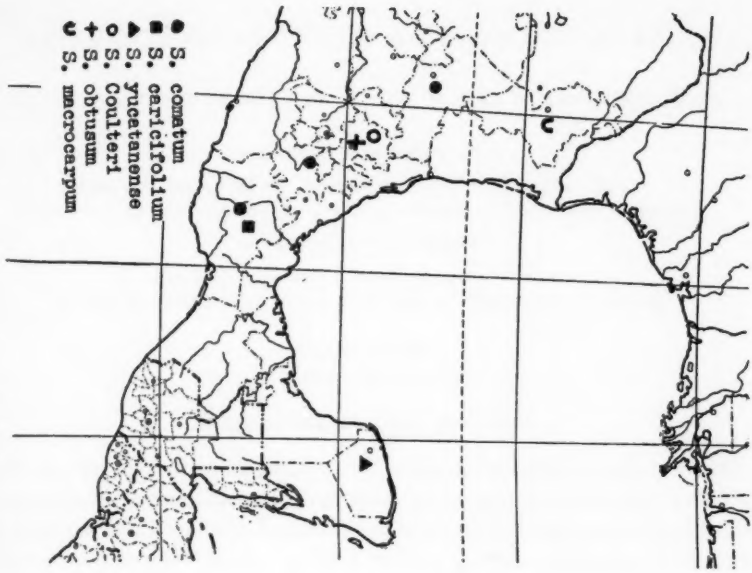


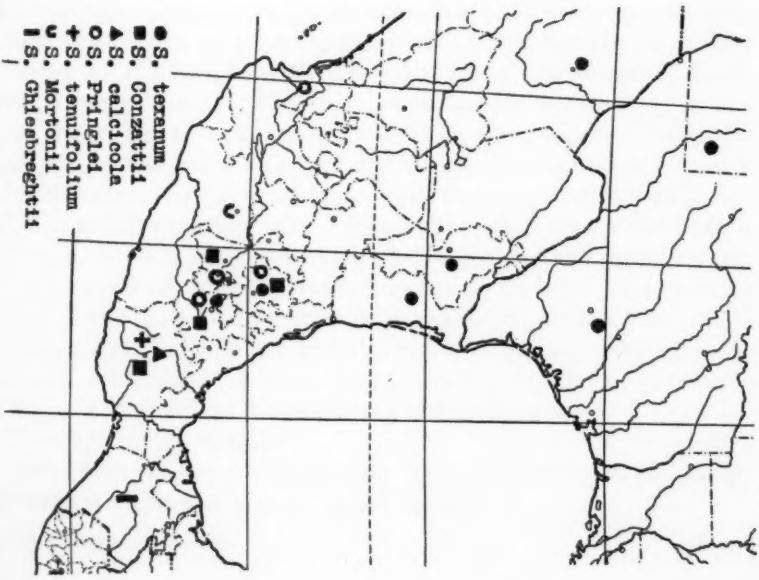
BRINKER—MONOGRAPH OF SCHOENOCAULON

EXPLANATION OF PLATE

PLATE 29

Maps showing geographical distribution of species of *Schoenocaulon*.


● S. comatum
■ S. cericifolium
▲ S. yucatanense
○ S. Coulteri
+ S. obtusum
ᑕ S. macrocarpum


● S. texanum
■ S. Conzattii
▲ S. calcicola
○ S. Pringlei
+ S. tenuifolium
ᑕ S. Mortonii
I S. Chiesbreghtii

CONTRIBUTIONS TOWARD A FLORA OF PANAMA [1]

VI. Collections chiefly by H. von Wedel in Bocas del Toro

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GRAMINEAE

(Jason R. Swallen)

Cryptochloa Swallen, gen. nov.

Monoecia; spiculis masculis et femineis in eadem inflorescentia dispositis; spiculae masculae: glumae et lemma sterile nulla; lemma acutum vel acuminatum, 1-nervio; palea lemma aequans; stamina 3; spiculae femineae: gluma prima nulla; gluma secunda et lemma sterile subaequalia acuta vel acuminata, 3–5-nervia, nervis lateralibus approximatis; fructus stipitatus, subcylindricus, firmus, albus vel fuscus, marginibus non involutis; palea lemma aequans. Perennis culmis gracilibus, planis, et laminis latis, planis, breve petiolatis.

Low monoecious perennial grasses with broad flat blades usually crowded toward top of the slender wiry culms. Inflorescence small, usually partly hidden in the upper sheaths, each bearing both staminate and pistillate spikelets in no definite arrangement; staminate spikelet: glumes and sterile lemma wanting; lemma and palea acute or acuminate, thin, the lemma 1-nerved; stamens 3; pistillate spikelet: first glume wanting; second glume and sterile lemma acuminate, subequal, 3- or usually 5-nerved, the lateral nerves approximate, finely transversely veined; fertile floret subcylindrical, raised on the enlarged and thickened segment of the rachilla; lemma firm, subindurate, smooth and shining, gradually narrowed to the blunt tip, the margins not inrolled; palea as long as the lemma, similar in texture.

A genus of southern Mexico and Central America.

Type species: *C. variana.*

Name from κρυπτὸς, hidden, χλόα, grass, referring to the partly enclosed panicles and also its forest habitat.

[1] Issued December 18, 1942.

This genus is closely related to *Raddia* Bertol. *(Strephium* Schrad., type *S. distichophyllum)* and has been confused with it. *Raddia,* however, has the staminate and pistillate spikelets in separate inflorescences (the staminate terminal or from the upper nodes, the pistillate axillary); the fertile floret is not raised on the lengthened and thickened segment of the rachilla; the fruit is much smaller, oval or ovate rather than subcylindrical, and the lateral nerves of the second glume and sterile lemma are evenly spaced rather than approximate.

Diandrolyra Stapf and *Olyra* L. are also close kin. The first is distinguished by the spikelets arranged in pairs, one staminate and one pistillate, the fruit is not raised on an enlarged segment of the rachilla, and the lateral nerves of the second glume and sterile lemma are evenly spaced rather than approximate. There are also only two rather than three anthers. In *Olyra* the panicles are all terminal on the main culm and branches, not axillary, the pistillate spikelets at the ends of the branches and the staminate below. The second glume and sterile lemma are usually attenuate, with the lateral nerves evenly spaced, not approximate. The fruit is sessile, relatively broad and thick, with the margins of the lemma inrolled, rather firmly clasping the palea.

KEY TO SPECIES

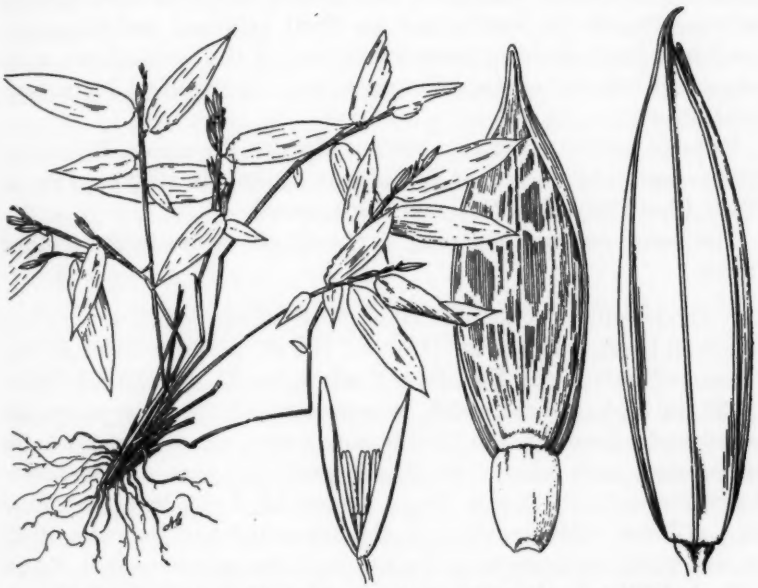
Culms 10–30 cm. high, slender; staminate spikelets 2.5–3 mm. long.
- Blades 3–5 at the summit of each culm, 3–5 cm. long, not conspicuously distichous ..... *1. C. variana*
- Blades 10–20 at the summit of each culm, 1.5–3 cm. long, conspicuously distichous ..... *2. C. concinna*

Culms 20–50 cm. high, at least some of them more than 30 cm., relatively coarse; staminate spikelets 4.5–5 mm. long.
- Panicles, or at least some of them, exserted on long slender peduncles; blades oblong, 3.5–5.5 cm. long, mostly 12–20 mm. wide; second glume and sterile lemma of pistillate spikelets smooth; lemma of staminate spikelets acute.. *3. C. strictiflora*
- Panicles, all of them, partly enclosed in the sheaths, the peduncles short; blades lanceolate, 6–7.5 cm. long, 10–13 mm. wide (occasionally as much as 10 cm. long and 27 mm. wide); second glume and sterile lemma of fertile spikelet granular-roughened; lemma of staminate spikelet subattenuate..... *4. C. granulifera*

1. CRYPTOCHLOA **variana** Swallen, sp. nov. Culmi caespitosi, 10–20 cm. alti, infra nodos pubescentes; vaginae carinatae marginibus pubescentibus; ligula 1–3 mm. longa, obtusa, pubescens; laminae 3–5 cm. longae, 8–13 mm. latae, oblongo-lanceolatae, acutae vel acuminatae, minute pubescentes; spiculae masculae 2.5 mm. longae, lemmate subacuto; antherae 1 mm. longae; spiculae femineae 7–8.5

mm. longae, gluma secunda et lemmate sterili acutis vel acuminatis, 3-nerviis, glabris; fructus 6.5–7 mm. longus, subcylindricus, fuscus.

Culms in small dense tufts, wiry, 10–20 cm. tall, erect to spreading, often geniculate at the densely pubescent nodes, glabrous, or pubescent below the nodes, the lower internodes somewhat elongate, the upper ones much shorter, completely hidden by the overlapping sheaths; sheaths keeled, pubescent toward the summit and on the margins, nearly glabrous on the back, often auriculate, the auricle



Cryptochloa variana: Plant, × ½; staminate spikelet, fruit, and pistillate spikelet, × 10.

fused with the ligule, the lower ones bladeless or with very much reduced blades; ligule 1–3 mm. long, membranaceous, obtuse, puberulent on the back or nearly glabrous; blades 3–5 on each culm, crowded toward the summit, 3–5 cm. long, 8–13 mm. wide, oblong-lanceolate, rather abruptly narrowed to an acute or acuminate tip, broad and rounded at the base, with a densely pubescent petiole about 1 mm. long, minutely pubescent on both surfaces or sometimes only obscurely puberulent; inflorescences terminal and axillary, partly enclosed in the sheaths, 2–3 cm. long, bearing 1–6 pistillate spikelets, the branches closely appressed, usually pubescent; staminate spikelet 2.5 mm. long, the lemma subacute, the palea as

long as or slightly longer than the lemma; anthers 1 mm. long; pistillate spikelet 7–8.5 mm. long, the pedicel 4–10 mm. long, relatively stout, much enlarged toward the summit; second glume and sterile lemma 3-nerved, with a few fine transverse nerves, glabrous or obscurely scaberulous, the second glume acute, the sterile lemma acute or subacuminate, slightly exceeding the second glume; fruit 6.5–7 mm. long, 2 mm. broad, subcylindrical, broadest above the middle, gradually narrowed to a blunt tip, smooth, shining, gray-greenish, at maturity mottled with darker drab; rachilla segment between the sterile lemma and the fruit enlarged and elongated, 1–1.5 mm. long, about as thick as the base of the fertile floret, whitish, somewhat soft or waxy in appearance; caryopsis 4.5 mm. long, light brown.

PANAMA: CANAL ZONE: near bank of Madden Reservoir, *Muenscher 12212.* COCLÉ: hills north of El Valle de Antón, alt. 1000 m., July 14, 1940, *Allen 2201* (U. S. National Herb., TYPE).

The name *variana,* meaning vari-colored, refers to the mottled fruits.

2. CRYPTOCHLOA **concinna** (Hook f.) Swallen, comb. nov. *(Olyra concinna* Hook. f. Bot. Mag. [Curtis] III, **52**: *pl. 7469.* 1896; *Raddia concinna* Chase, Proc. Biol. Soc. Washington **21**: 185. 1908.). Culms 15–30 cm. high, slender, erect, or geniculate at the lower nodes, the lower and especially the middle internodes much elongated, the upper ones very short; sheaths keeled, glabrous or pubescent; ligule truncate, 0.3–1 mm. long; blades 1.5–3 cm. long (usually 2 cm.), 5–9 mm. wide, crowded on the upper third of the culm, 10–20 on each culm, conspicuously distichous; inflorescences small, almost entirely hidden in the uppermost sheaths; fertile spikelet 8–10 mm. long, the second glume and sterile lemma subequal, subacuminate, 3–5-nerved, with fine transverse veins, glabrous; fruit about 8 mm. long, subcylindrical, scarcely broadened above the base, gradually narrowed to the blunt or rounded tip.

Wet forests at low altitudes, Nicaragua, Costa Rica, and Colombia.

NICARAGUA: Sandy Bay, 1922, *Hamilton s.n.*

COSTA RICA: LIMÓN: Hamburg Finca, Río Reventazón below Cairo, *Standley 48661, 48783, 48854; Oesterr. Biol. Costarica-Expedition 680,* 1930, (coll. *Cufodontis).*

COLOMBIA: BOLÍVAR: Norosi-Tiquisio trail, Lands of Loba, *Curran 129.*

3. CRYPTOCHLOA **strictiflora** (Fourn.) Swallen, comb. nov. (*Strephium strictiflorum* Fourn. Bull. Soc. Bot. Belg. **15**: 465. 1876; *Olyra strictiflora* Hemsl. Biol. Cent. Am. Bot. **3**: 510. 1885; *Raddia strictiflora* Chase, Proc. Biol. Soc. Washington **21**: 185. 1908.). Culms 20–50 cm. high, erect or geniculate at the lower nodes, pubescent, more so on one side than the other, the nodes retrorsely pubescent, the intermediate internodes elongate; sheaths keeled, glabrous or pubescent; ligule 2–3 mm. long, obtuse, fused with the auriculate summit of the sheath; blades scarcely crowded, sometimes not at all, oblong, 3.5–5.5 cm. long, 12–20 mm. wide, abruptly narrowed to an acute tip, glabrous or minutely puberulent, the margins scabrous; inflorescences terminal and axillary from the middle and upper sheaths, at least some of them on long slender exserted peduncles; staminate spikelets 4.5 mm. long, the lemma acute; fertile spikelet 11–12 mm. long, the second glume and sterile lemma acuminate, subequal, 5-nerved, very faintly transversely veined; fruit 7 mm. long, subcylindrical with nearly parallel margins, ivory-white.

Gulf region of Mexico.

MEXICO: VERACRUZ: Mirador, *Liebmann 266;* Hacienda de Jovo, *Liebmann 267;* Córdoba, 1865-66, *Bourgeau.*

4. CRYPTOCHLOA **granulifera** Swallen, sp. nov. Culmi graciles, erecti, ad 50 cm. alti, nodiis pubescentibus; vaginae carinatae glabrae vel ad apicem pubescentes; ligula 0.5–2 mm. longa, obtusa; laminae lanceolatae, 6–7.5 cm. longae, 10–13 mm. latae, acuminatae, marginibus scabris; paniculae 2–5 cm. longae, contractae; spiculae masculae 4.5–5 mm. longae, lemmate subattenuato; spiculae femineae 11–12 mm. longae, gluma secunda et lemmate sterili acuminatis, 5-nerviis, granulosis; fructus 7–8 mm. longus, albus.

Culms slender, erect, occasionally somewhat geniculate at the lower nodes, as much as 50 cm. high, pubescent in a line on one side, the nodes retrorsely pubescent, otherwise glabrous; sheaths keeled, glabrous, or pubescent toward the summit, mottled with dark spots; ligule 0.5–2 mm. long, obtuse, pubescent, fused with the auriculate summit of the sheath; blades broadly lanceolate, the upper ones 6–7.5 cm. long, 10–13 mm. wide (sometimes 20 mm.), rather gradually narrowed to an acuminate tip, glabrous on both surfaces, the margins scabrous; panicles 2–5 cm. long, contracted, partly enclosed in the upper sheaths; staminate spikelets 4.5–5 mm. long, the lemma acuminate or subattenuate, appearing as if awned; fertile spikelet 11–12 mm. long, the second glume and sterile lemma subequal, acu-

minate, 5-nerved, finely transversely nerved, granular-roughened; fruit 7–8 mm. long, ivory-white, narrowed at the summit to a blunt tip.

Forests, Mexico, Honduras and Guatemala.

MEXICO: VERACRUZ: Fortuña, Coatzacoalcos River, *Williams 8378.* CHIAPAS: Finca Irlanda, *Purpus 7403.*

HONDURAS: Puerto Siena, forest along Tela River, Feb. 4, 1903, *Wilson 325* (U. S. National Herb., TYPE).

GUATEMALA: SAN MARCOS: Río Mopá, below Rodeo, *Standley 68769.* This specimen differs from the type in having blades as much as 10 cm. long and 27 mm. wide.

CYCLANTHACEAE

CARLUDOVICA DRUDEI Mast.—CHIRIQUÍ: vicinity of Puerto Armuelles, alt. 0-75 m., July 28-31, 1940, *Woodson & Schery 910.* Originally described from plants of Colombian origin cultivated at Kew.

CARLUDOVICA ENSIFORMIS Hook.f.—CHIRIQUÍ: vicinity of Bajo Chorro, alt. 1900 m., July 20-22, 1940, *Woodson & Schery 625*; Casita Alta to Cerro Copete, Volcán de Chiriquí, alt. 2300-3300 m., July 10, 1940, *Woodson & Schery 373.* Previously considered to be an endemic of Costa Rica.

CARLUDOVICA **integrifolia** Woodson, sp. nov. Planta ut videtur gracilis scandens. Folia longiuscule petiolata membranacea; lamina 22–30 cm. longa 4–6 cm. lata elliptico-oblanceolata apicem versus late acuta ibique levissime crenulata deinde abrupte angusteque subcaudato-acuminata basim versus (ca. 2/3 longitudine) integra gradatim acuta; petiolo 12–15 cm. longo ca. 2/3 longitudine vaginato. Pedunculus 5–6 cm. longus tenuis, spatharum nodiis ca. 3 sat distantibus. Spadix in fructu immaturo fusiformi-cylindricus ca. 2.0–2.5 cm. longus basi ca. 0.4 cm. crassus; floribus femineis parvis concrescentibus ca. 0.5 cm. diam., stigmatibus sessilibus parvis, lobis perigonialibus tenuissimis vix manifestis. Spathae deciduae ut videntur ca. 3 parvae pedunculi in parte dimidia superiore gestae.—DARIÉN: along the Sambú River, southern Darién, above tide limit, Feb., 1912, *Pittier 5560* (U. S. Nat. Herb., TYPE).

As far as I am aware, only three species of *Carludovica* previously have been described with entire leaves: *C. diversa* Drude, *C. Trailiana* Drude, and *C. heterophylla* Mart., all from Brazil. The three species previously described apparently were found with both entire and bifid leaves (the entire leaves all of outline significantly different from ours), with larger spadices, and with only 1 or 2 spathes.

Our type specimen bears 6 leaves, all entire and so uniform as to indicate that to be the normal condition of the foliage.

Another entire-leaved *Carludovica* was collected by P. C. Standley in the garden of C. W. Powell at Balboa, C. Z., in 1925. The specimen (in U. S. Nat. Herb. no. 1252076) consists of a single leaf of the same general outline as those of *C. integrifolia* but much larger (about 50 cm. long, 12 cm. broad), and is accompanied by the following remarks: "Said to be from the nearby woods. Acaulescent. Leaves all simple." No similar plants have been encountered in the Canal Zone since that time, and the cultivated plant apparently was lost when Mr. Powell's collections were removed by the Missouri Botanical Garden.

CARLUDOVICA KILLIPII Standl.—DARIÉN: Cerro de Garagará, Sambú basin, southern Darién, alt. 500–974 m., Feb. 7, 1912, *Pittier 5658*. Originally described (Field Mus. Publ. Bot. **22**: 65. 1940) from the region of Buenaventura Bay, Colombia. I have not been able to check the Pittier specimen with that of Killip, but Schery, who has seen both, regards them as probably conspecific.

CARLUDOVICA MICROCEPHALA Hook.f.—BOCAS DEL TORO: Water Valley, Sept. 23, 1940, *H. von Wedel 921*. Previously known to occur in the Greater Antilles, Honduras, and Costa Rica.

CARLUDOVICA MICROPHYLLA Oerst.—CHIRIQUÍ: Río Chiriquí Viejo valley, April 8, 1938, *G. White 75;* vicinity of Bajo Mona and Quebrada Chiquero, alt. 1500 m., July 18, 1940, *Woodson & Schery 567*. Previously considered as an endemic of Costa Rica. *White 75* is quite typical of the species as exemplified by other herbarium specimens. However, *Woodson & Schery 567* has very slender leaves attaining 60 cm. in length and seems to correspond perfectly with the diagnosis of *C. stenophylla* Standl. (Fl. Costa Rica, p. 130. 1937) which was described from sterile plants. Our flowering and fruiting specimens have inflorescences quite conformable with those of *C. microphylla,* particularly with regard to the persistent spathes. Since similarly sharp leaf variation has been found to occur in other species represented by a number of herbarium specimens (cf. *C. ensiformis* and *C. Oerstedii*), we are tentatively regarding *C. stenophylla* as a synonym of *C. microphylla.*

CARLUDOVICA **Pittieri** Woodson, sp. nov. Planta mediocris ut videtur subacaulis. Folia longe-petiolata membranacea; lamina ca. 28 cm. longa medio ca. 15 cm. lata apicem versus ca. 1/4 longitudine bifida, segmentis late ovato-trigonalibus late acutis; petiolo 19 cm. longo evaginato. Pedunculus 5 cm. longus prope medium 2 nodiis

bractealibus (bracteis deciduis). Spadix in fructu globosus ca. 2.0–2.5 cm. diam.; floribus femineis sat magnis concrescentibus ca. 0.8 cm. diam., stigmatibus sessilibus, lobis perigonialibus depressis stigmata vix aequantibus.—SAN BLAS: high hills back of Puerto Obaldía, alt. 50–200 m., Aug., 1911, *Pittier 4312* (U. S. Nat. Herb., TYPE).

This species is conspicuous amongst the Central American Carludovicas because of its broad, scarcely divided leaves, recalling those of *C. latifrons* Drude of Brazil. The latter, however, has more deeply divided leaves of a different shape, and the stigmas are supported by rather slender styles.

CARLUDOVICA ROTUNDIFOLIA Wendl.—CHIRIQUÍ: Quebrada Velo, Volcán de Chiriquí, alt. 1800 m., July 8, 1940, *Woodson & Schery 248*; vicinity of Bajo Chorro, alt. 1900 m., July 20-22, 1940, *Woodson & Schery 675*. Originally described from Costa Rican plants grown at Kew. *C. rotundifolia* has usually been regarded as a synonym of the widespread *C. palmata* R. & P., but it probably should be maintained from the latter on the basis of the more elongate fruiting perigonial lobes and foliaceous outer spathes of the inflorescence.

COMMELINACEAE

COCHLIOSTEMA ODORATISSIMUM Lem.—BOCAS DEL TORO: Isla Lobo, Chiriquí Lagoon, Sept. 6, 1941, *H. von Wedel 2627*. "Wercklé has published the following statement: 'In the mountains south of Turruvares a gigantic *Cochliostema* is abundant, and covers the thick trunks of trees. It is a very beautiful epiphyte.' He reports it also from the Cordillera de Dota, as a plant 2 meters in height. The genus is known only from Ecuador, but probably it is represented also in Costa Rica." [Standl. Fl. Costa Rica, p. 163. 1937]. This is one of the most interesting discoveries in Panama during recent years, and it comes as a distinct surprise, also, to find it growing so near sea-level, instead of in the mountains where it might have been expected. Although the species is so infrequently collected that I have not been able to compare our plant with other herbarium specimens from South America, the determination appears to be established by reference to the numerous published icones. Of *C. odoratissimum*, Sir J. D. Hooker wrote: "This superb plant certainly ranks amongst the grandest stemless Monocotyledons known, combining the foliage of a gigantic *Anthurium* with masses of inflorescence which, for size, delicacy, and beauty of tints, cannot well be surpassed." [Bot. Mag. *pl. 5705*. 1868.]

LILIACEAE

ECHEANDIA **prolixa** Woodson, sp. nov. Herbae perennes 6–10 dm. altae omnino glabrae; rhizoma brevi recta; radicibus multis carnosis tuberos elongato-fusiformes gerentibus. Folia plurima radicalia late linearia 60–95 cm. longa ca. 2 cm. lata, caulina 1–2 minora. Inflorescentia prolixa plus minusve procumbens paniculato-racemiformis; ramis 3–6 saepissime 2–4 ex axilla unica; bracteis scariaceis minimis. Flores parvi in fasciculis aggregati; pedicellis 1.0–1.5 cm. longis sub medio articulatis; perianthii segmentis anguste oblongo-linearibus 1.0–1.2 cm. longis ca. 0.1 cm. latis albis patulis; staminis antheris oblongo-sagittatis 0.6 cm. longis, filamentis rugosis aequilongis. Capsulae trigone obovoideo-oblongoideae apice truncatae vel leviter emarginatae basi attenuatae 0.7–0.8 cm. longae ca. 0.4 cm. latae.—PANAMÁ: vicinity of Bejuco, alt. about 20 m., Sept. 7, 1942, *P. H. Allen 2962* (Herb. Missouri Bot. Gard., TYPE). "Common weedy herb growing in lax clumps on rocky hilltops. Inflorescence weakly procumbent in most cases. Flowers white with yellow stamens."

This species is conspicuous amongst described Echeandias because of its rank growth. It is most nearly allied to *E. macrophylla* Rose, but material of that species which is available for study shows plants which are smaller in general stature, with anthers about 1 cm. long and filaments about 0.6 cm. long, as well as broader almost exactly ovoid capsules. The genus *Echeandia* has previously been known only from southern Mexico and northern Central America, with the exception of a single specimen (*Fendler 1549*) from northwestern Venezuela which possibly represents *E. prolixa*. An additional *Echeandia* is known from western Panama:

ECHEANDIA **venusta** Woodson, sp. nov. Herbae perennes ca. 3–4 dm. altae omnino glabrae; rhizoma brevi recta; radicibus multis carnosis. Folia plurima radicalia late linearia 12-30 cm. longa 1.0–1.5 cm. lata multinervia albomarginata, caulina 1–2 multo minora. Inflorescentia racemiformis saepissime simplex; floribus in fasciculis aggregatis vel solitariis; bracteis exterioribus valde foliaceis spathaceis 2–7 cm. longis; pedicellis 1.5–2.0 cm. longis sub medio articulatis; perianthii segmentis aureis nervis 3 nigris oblongo-ellipticis 1.5–2.0 cm. longis 0.4–0.5 cm. latis; staminis antheris anguste oblongo-sagittatis ca. 0.6 cm. longis, filamentis 0.5 cm. longis rugoso-crispatis.—CHIRIQUÍ: Potrero Muleto, Volcán de Chiriquí, alt. 3500 m., July 13, 1940, *Woodson & Schery 379* (Herb. Missouri Bot. Gard., TYPE).

E. venusta is closely related to the group of rather dubious species centering about *E. reflexa* (Cav.) Rose, but differs from all in its conspicuously spathaceous bracts and somewhat larger flowers with longer pedicels. The species was very abundant at the type locality, and as charming as a planned floral display; it is well worthy of cultivation in northern greenhouses.

SMILACACEAE

(C. V. Morton[1])

SMILAX **chiriquensis** Morton, sp. nov. Liana 7.5 m. longa, caulibus conspicue et argute quadrangularibus, pallide lutescentibus, glabris, parce aculeatis, aculeis rectis vel curvatis, basi latis; petioli elongati, usque ad 6 cm. longi, glabri, medio vel supra medium articulati; laminae foliorum ovatae, usque ad 19 cm. longae et 12 cm. latae, apice breviter apiculatae, majores basi cordatae, minores basi truncatae, omnes integrae, non lobatae, papyraceae, pallide virides, glabrae, 9-nerviae, nervis extimis marginalibus, venis secundariis perspicue reticulatis, utrinque elevatis; umbellae masculae in ramis axillaribus brevibus foliis suffultis, vel foliis valde reductis umbellis pseudoracemosis; pedunculus 1–3 cm. longus, glaber, complanatus, quam petiolus longior; receptaculum parvum; pedicelli 5–11 mm. longi, glabri; perianthium viride, segmentis linearibus, 8–9 mm. longis, ca. 1.5 mm. latis, recurvis, glabris; filamenta gracilia, ca. 6 mm. longa, antheris parvis, ca. 1.5 mm. longis; flores feminei ignoti.—CHIRIQUÍ: valley of the upper Río Chiriquí Viejo, March 22, 1940, *Peggy White 348* (U. S. Nat. Herb., no. 1,791,114, TYPE); same locality, April 3, 1938, *Gene White 59*; Bajo Mona, Boquete, alt. 1350 m., April 2, 1938, *M. E. Davidson 478*.

This species belongs to the section Hispidae of the revision of Killip and Morton. It may be distinguished from all the continental American species of that group by its sharply quadrangular stems, large, long-petioled leaves, large flowers, and minute anthers. The Davidson specimen was distributed as *S. Regelii* Killip & Morton, to which it is not closely allied. *S. Regelii* has the perianth segments only 3.5–5 mm. long (rather than 8–9 mm., as in *S. chiriquensis)* and the anthers are longer than the very short (1.2 mm.) filaments. In *S. chiriquensis* the anthers are very small, much shorter than the elongate filaments, these about 6 mm. long.

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DIOSCOREACEAE

(C. V. Morton)

DIOSCOREA STANDLEYI Morton—CHIRIQUÍ: vicinity of Bajo Chorro, alt. 1900 m., July 20-22, 1940, *Woodson & Schery 652* and *664*. Previously known from Costa Rica.

IRIDACEAE

NEOMARICA CAERULEA (Ker-Gawl.) Sprague—BOCAS DEL TORO: Little Bocas, July 16, 1941, *H. von Wedel 2546*. This species occurs naturally from the Guianas to southern Brazil, according to J. G. Baker (Handb. Irid.). Out of this range, it has been cited from cultivation in highland Costa Rica by Standley (Fl. Costa Rica). Consequently, whether the species is indigenous or an escape is open to question, although Mr. von Wedel usually is careful to limit his collections to apparently indigenous plants. The plant resembles a gigantic *Sisyrinchium* with scapes 1.5–2 m. tall and violet-blue flowers 5–6 cm. in diameter.

MUSACEAE

HELICONIA PSITTACORUM L.f. (*H. hirsuta* L.f. Suppl. 158. 1781; *H. cannoidea* L.Rich. Nova Acta Acad. Nat. Cur. **15**, suppl.: *pls. 9–10.* 1831; *H. aurantiaca* Ghiesbreght ex Lem. Ill. Hort. *pl. 332.* 1862; *H. straminea* (Griggs) Standl. Fl. C. Z. 75. 1928).—Unless one shares the rather naive faith in the constancy of *Heliconia* species suggested by some recent authors, one must assume great complexity for this species, particularly with regard to such characters as length of the peduncle and color of bracts and flowers. Fortunately, the species is common in Panama, and has been collected abundantly. *H. psittacorum* and *H. hirsuta* were published in the same work by the younger Linnaeus (Suppl. 158. 1781), and since they have not been combined previously, I am adopting the former as more expressive of the aspect of the plants.

HELICONIA ROSTRATA R. & P. (*H. pendula* Wawra, Oesterr. Bot. Zeitschr. **13**: 8. 1861; *H. curtispatha* Petersen in Mart. Fl. Bras. **3**[3]: 15. 1890; *H. longa* Griggs, Bull. Torrey Club **31**: 446. 1904).—It is difficult to see why modern authors have failed to recognize the essential similarity of the plants bearing these names to the suggestive illustration published by Ruiz and Pavon (Fl. Peruv. **3**: *pl. 305.* 1802).

HELICONIA SUBULATA R. & P. Fl. Peruv. **3**: *pl. 303.* 1802. (*H. acum-*

inata L. C. Rich. Nova Acta Acad. Nat. Cur. **15**, suppl.: *pl. 11.* 1831; *H. psittacorum* L. f. var. β. *subulata* (R. & P.) Baker, Ann. Bot. **7**: 199. 1893).—A thoughtful interpretation of the illustrations, crude as they are, makes their association as synonyms quite inescapable for me.

HELICONIA VELLERIGERA Poeppig, Reise Chile **2**: 295. 1836; Peters. in Mart. Fl. Bras. **3**[3]: 18. 1844; K.Sch. in Engl. Pflanzenreich **4**[45]: 37. 1900. *(Bihai vellerigera* (Poeppig) O.Ktze. Rev. Gen. **2**: 685. 1891; Griggs, Bull. Torrey Club **4**[2]: 318. 1915).—COCLÉ: El Valle de Antón, *Woodson & Schery 205, Allen 1818;* Las Minas, *Allen 2707;* PANAMÁ: Río Boquerón, *Hunter & Allen 659.* This is one of the most striking species of *Heliconia,* attaining a height of 3 meters, the long inflorescences pendulous and clothed with very dense and brilliantly ferruginous hairs about 1 cm. long (the brilliant scarlet bracts and upper peduncle occasionally somewhat glabrate).

The identification of the Panamanian plants with Poeppig's has not been entirely an easy matter, although a guiding principal in our dealings with highland Panamanian plants has been liberal consultation of the disused species of Peru enumerated by Ruiz & Pavon and Poeppig. The complicating factor in this instance was that *H. vellerigera* is not represented by exsiccatae in American herbaria which we have consulted, and was known to Poeppig, Petersen, and Schumann only from a fragment of an inflorescence in the herbarium at Vienna. Schumann undertook to key the species from others on the basis of a supposedly erect inflorescence, which was repeated by Griggs. Nevertheless, we were struck with the fact that both Petersen and Schumann took pains to describe the indument of the inflorescence as *"pili. .ad 1 cm. longi"* amplified by the former by the remark, *"Species incomplete cognita, sed vellere ad omnibus ceteris Heliconiis distinctissima,"* and we hopefully labelled our Panamanian specimens as *H. vellerigera.*

Faith in our rather intuitive use of the early Peruvian authors has recently been vindicated in this case by examination, through the kindness of Dr. Standley, of two photographs of *H. vellerigera* from Peru; one specimen, the type of Poeppig, preserved in the herbarium at Vienna, and the other, a recent collection *(Weberbauer 6764)* in the herbarium at Berlin. There can be scarcely a shadow of doubt that the plants of Panama and those of Peru are quite conspecific. Unfortunately, the label of Weberbauer's plant does not indicate whether the inflorescence was erect or pendulous, but the latter almost certainly must have been the case.

HELICONIA VILLOSA Kl. (*Heliconia nutans* Woods. Ann. Missouri Bot. Gard. **26**: 276. 1939).—CHIRIQUÍ: Volcán de Chiriquí, alt. 1500–2000 m., *Woodson, Allen & Seibert 968*; COCLÉ: north of El Valle, alt. 1000 m., *Allen 2167*. Intensive study of the Panamanian Heliconias has convinced me of the folly of continuing the tenuous specific distinctions current at present. The species undoubtedly are extremely variable in all but the most conservative criteria, and hybridization may be suspected in several instances. The specimens cited above agree in all essential particulars with the original description of *H. villosa* and the illustration by Petersen in the 'Flora Brasiliensis' (3³: *pl. 4.* 1890). Particularly is this true with regard to the specimen from the Province of Coclé. The type of *H. nutans* (*Woodson, Allen & Seibert 968*) is merely a specimen with somewhat more numerous and smaller bracts. The indument is rather variable, and nearly glabrous specimens have been observed, particularly in the northern range of the species which appears to extend as far as Honduras.

ZINGIBERACEAE

RENEALMIA (*Scaposae-Racemosae*) **Arundinaria** Woods. sp. nov. Herba gracillima omnino glabra. Culmi foliiferi gracillimi 3–4 dm. alti. Folia longiuscule (0.5–1.0 cm.) petiolata angustissime oblongo-lanceolata basi apiceque attenuata 7–15 cm. longa 1.0–1.7 cm. lata superne minora; ligula angusta 3–6 cm. longa truncata vel obscure auriculata purpureo-marginata. Panicula racemiformis pauciflora; culmis gracillimis 5–7 cm. longis, vaginis ca. 5–6 oblongo-ovatis obtusis 1.25–1.5 cm. longis membranaceis; pedunculis 2.5–3.0 cm. longis 8–12-floris; bracteis ovatis vel ovato-lanceolatis 0.5–0.7 cm. longis pallide roseis. Flores ignoti. Capsula ovoidea 0.6–0.7 cm. longa coccinea; calyce anguste turbinato ca. 0.5 cm. longo; pedicello ca. 0.5 cm. longo.—DARIÉN: foothills of Garagará, Sambú basin, southern Darién, alt. 30–500 m., Feb., 1912, *Pittier 5597* (U. S. Nat. Herb., TYPE; Gray Herb., ISOTYPE).

Because of its narrow, grass-like leaves and short, few-flowered racemiform inflorescences, this species does not coincide with any other previously published with which I am familiar.

COSTUS FRIEDRICHSENII O. G. Peters. Bot. Tidsskr. **18**: 260. 1893. —This name should apply to the plants assigned to *C. argenteus* R. & P. in the third of this series (Ann. Missouri Bot. Gard. **26**: 277. 1939), as a result of my perhaps overly zealous eagerness to resuscitate the disused species of the 'Flora Peruviana.' The illustration

by Ruiz and Pavon certainly bears great similarity to our plants. Since the publication of my note, however, I have received for identification a Bolivian specimen (*Krukoff 10489*) which agrees even better with the illustration and which has such a strikingly distinctive silvery indument that Ruiz and Pavon's epithet is the involuntary one to describe it. Most fortunately, about the same time I received on loan the type specimen of *C. Friedrichsenii* from Berlin. The latter undoubtedly is the plant from Panama so frequently confused with *C. villosissimus*.

Costus laevis R. & P. Fl. Peruv. **1**: 3. 1798 (*C. giganteus* O. Ktze. Rev. Gen. **2**: 687. 1891, non Ridl.; *C. maximus* K. Sch. in Engl. Pflanzenreich, **4**[46]: 405. 1904; *C. splendens* Donn. Sm. et Tuerckh. Bot. Gaz. **32**: 260. 1902; *C. Skutchii* Morton, Jour. Wash. Acad. Sci. **27**: 306. 1937).—The identification of this name of Ruiz and Pavon with the magnificent plants of Panama and southern Central America is made through an examination of the type specimen in the herbarium at Madrid and notes kindly supplied by Dr. Loesener of Berlin.

Costus ruber Griseb. Cat. Pl. Cub. 256. 1866 (*C. formosus* Morton, Jour. Wash. Acad. Sci. **27**: 305. 1937; *C. spicatus* Jacq. according to many authors; *C. spiralis* (Jacq.) Roscoe, according to K. Sch. in Engl. Pflanzenreich, **4**[46]: 400. 1904).—chiriquí: Puerto Armuelles, alt. 0–75 m., *Woodson & Schery 857*; San Bartolomé, *Woodson & Schery 886*; coclé: El Valle, alt. 800–1000 m., *Allen 1825*; canal zone: Gold Creek, *Seibert 584*; Barro Colorado Isl., *Woodson & Schery 993*; darién: Pinogana, alt. 20 m., *Allen 938*. The identification of these plants with *C. ruber* is made quite positive by an examination of *Wright 1514*, from eastern Cuba, cited by both Grisebach and Schumann. The species is one of the most attractive and frequent of southern Central America, well characterized by its ordinarily red flowers and bracts, the latter with margins densely ciliate, and rather large obovate or oblanceolate leaves. It is difficult to understand how Schumann was able to harmonize *C. ruber* as represented by *Wright 1514* with Roscoe's excellent illustration of *C. spiralis* (Monandr. Pl. *pl. 79.* 1828), which shows with particular detail the characteristic obovate-oval leaves with subcordate-auriculate base of the latter. In addition, *C. spiralis* is quite glabrous in all parts.

Costus scaber R. & P. Fl. Peruv. **1**: 2. *pl. 3.* 1798.—coclé: near Cerro Turega, 650–700 m., *Woodson & Schery 202*; panamá: hills above Campana, 600–800 m., *Allen 1873*. Our plants agree closely

with a photograph of the type specimen in the Madrid herbarium, and with the published illustration. I believe that this species extends to the Chiriquí region, and probably hybridizes with *C. nutans* K. Sch. throughout its range.

COSTUS SPIRALIS (Jacq.) Roscoe, Monandr. Pl. *pl. 79.* 1828.—BOCAS DEL TORO: Old Bank Island, Chiriquí Lagoon, *H. von Wedel 2000*; Isla Colón, *von Wedel 2939*; Isla Bastimentos, *von Wedel 2899.* These specimens agree strikingly with Roscoe's illustration, particularly with regard to the leaf shape, as has been discussed in a preceding paragraph.

CANNACEAE

CANNA FLACCIDA Salisb.—BOCAS DEL TORO: Isla Colón, March 30, 1940, *H. von Wedel 78.* A new record for Central America. Previously known to occur in coastal South Carolina, Georgia, and Florida; also in Cuba and Hispaniola. The islands of the Chiriquí Lagoon apparently contain numerous Antillean elements.

CANNA GLAUCA L.—BOCAS DEL TORO: Old Bank Island, Chiriquí Lagoon, Feb. 5, 1941, *H. von Wedel 2001.* Apparently the first record for Central America. Previously known to occur in the Antilles, the Guianas, and northern Colombia.

MARANTACEAE

CALATHEA VILLOSA Lindl. Bot. Reg. **31**: *pl. 14.* 1845 (*C. hirsuta* Standl. Jour. Wash. Acad. Sci. **15**: 4. 1925).—This correction serves to re-emphasize by so much the affinities of the Panamanian flora for that of northeastern South America.

CALATHEA (*Pseudophrynium-Scapifoliae*) **Allenii** Woods. sp. nov. Planta 1 m. alta. Folia longiuscule petiolata; lamina oblongo-elliptica basi rotundata apice abrupte subcaudato-acuminata 20–45 cm. longa 8–15 cm. lata supra nervo medio excepto glabra subtus nervo medio praecipue minute puberula, petiolo ad 25 cm. longo pilosulo parte superiore ad 5 cm. callosa tereti, vagina ad 10 cm. longa 4 cm. lata dorso margineque pilosulis. Spica late fusiformis 11–13 cm. longa 3.0–3.5 cm. crassa sessilis vel pedunculo dense pilosulo ad 4 cm. longo, bracteis (ca. 20–25) dense imbricatis oblongis inferne late ovalibus apice late rotundato-emarginatis frequenter cuspe minuto ad medium munitis 5.0–5.5 cm. longis 1.5–3.5 cm. latis luteis marginibus apiceque praecipue pilosulis glabratisve. Flores ascendentes fasciculati bracteolis oblongo-linearibus ad 4 cm. longis; ovario ca. 0.4 cm. longo apice villoso; sepalis anguste

oblongo-lanceolatis acutis ca. 3 cm. longis glabris; corolla lutea extus minute sparseque pilosula, tubo angustissimo ca. 3.5 cm. longo, lobis staminodioque ca. 1.0–1.3 cm. longis.—PANAMÁ: summit of Cerro Campana, alt. 800–1000 m., Sept. 1, 1940, *P. H. Allen 2218* (Herb. Missouri Bot. Gard., TYPE).

The rather narrowly fusiform, sessile or very shortly pedunculate spikes of this species are very distinctive, as are the peculiarly emarginate bracts.

CALATHEA ALLOUIA (Aubl.) Lindl. Bot. Reg. **14**: sub *pl. 1210.* 1828. (*Maranta Allouia* Aubl. Hist. Pl. Guian. **1**: 3. 1775; *C. grandifolia* Lindl. Bot. Reg. **14**: *pl. 1210.* 1827; *Phrynium cylindricum* Roscoe, Monandr. Pl. *pl. 40.* 1828; *Calathea cylindrica* (Roscoe) K. Sch. Engl. Pflanzenreich, **4**[48]: 83. 1902; *C. macrosepala* K. Sch. loc. cit. 84. 1902).—After intermittent consideration for several years, I have come to the firm conviction that the showy plants of southern Central America and northern South America usually identified as *C. violacea* (Rosc.) Lindl. and *C. macrosepala* K. Sch. are quite conspecific and represent merely minor varieties with blue or pale yellow varieties respectively; nor is there much doubt in my mind that Aublet's name should be applied to them. Upon numerous occasions I have collected the two varieties growing intermixed, and Mr. Allen has confirmed my observations independently. The typical variety is that with the pale yellow flowers; that with blue flowers may be indicated as follows:

CALATHEA ALLOUIA (Aubl.) Lindl. var. **violacea** (Roscoe) Woods., comb. nov. (*Phrynium violaceum* Roscoe, Monandr. Pl. *pl. 37.* 1828).

CALATHEA *(Pseudophyrnium-Scapifoliae)* **foliosa** Rowlee, sp. nov. Planta submetralis et humilior. Folia folio 1 caulino excepto sub pedunculo ca. 7–10 dense rosulata, lamina oblongo-lanceolata apice breviter acuminata basi obtusa ad 32 cm. longa 8 cm. lata nervo medio subtus minute puberulo caeterum glabra, petiolo 1 cm. longo tota longitudine calloso, vagina angusta obtusa 15–20 cm. longa glabra. Spica globosa ca. 6 cm. diametro, pedunculo ca. 9 cm. longo glabro, bracteis ca. 25 plus minusve imbricatis late ovatis breviter acuminatis 2–3 cm. longis extus intusque dense tomentellis. Flores ut videntur gilvi fasciculati; ovario glabro; sepalis lanceolatis 3 cm. longis; corollae tubo 1.5 cm. longo lobis ellipticis 1 cm. longis staminodio elliptico 0.7 cm. longo.—BOCAS DEL TORO: Farm 6, near Almirante, Sept. 23, 1920, *N. W. Blair 1016* (U. S. Nat. Herb., TYPE).

This manuscript species of the late Prof. Rowlee appears to be most closely related to *C. indecora,* described in a previous paragraph of this report. The lower stature, acuminate bracts, and particularly the rosulate leaves render it distinctive. Rosulate cauline leaves have been reported previously for the genus in *C. Pearcei* Rusby, of Bolivia, with which *C. foliosa* can claim little close relationship.

CALATHEA (*Pseudophrynium-Scapifoliae*) **indecora** Woods., sp. nov. Planta valida 2.0–2.5 m. alta. Folia longe petiolata, lamina oblongo-elliptica basi rotundata apice breviter acuminata 40–65 cm. longa 14–22 cm. lata supra nervo medio puberulo caeterumque glabra subtus minute puberula, petiolo 20–45 cm. longo minutissime pilosulo parte superiore ad 4 cm. longa callosa tereti dense papillata, vagina 11–20 cm. longa haud auriculata. Spica late ovoidea 5–8 cm. longa, pedunculo valido 10–18 cm. longo superne puberulo, bracteis (ca. 15–30) latissime ovatis subrotundatis ca. 2 cm. longis latisque pallide viridibus dense pilosulis ad anthesim laceratis laxe patulis. Flores ad anthesim patuli; ovario 0.2 cm. longo glabro; sepalis anguste oblongis acutis 2 cm. longis glabris superne minutissime pilosulis; corollae lacteae glabrae tubo angustissimo ca. 2 cm. longo, lobis obovato-ellipticis 1.5 cm. longis, staminodio 1 cm. longo.—BOCAS DEL TORO: Isla Colón, Aug. 15, 1940, *H. von Wedel 476* (Herb. Missouri Bot. Gard., TYPE); Old Bank Island, Feb. 15, 1941, *von Wedel 2102*; Isla Colón, Oct. 18, 1940, *von Wedel 1229*; Water Valley, Sept. 11, 1940, *von Wedel 712.*

Dr. Schery and I were with Mr. von Wedel when the type specimens were collected in fairly low woods on Isla Colón. On the basis of dried plants alone I might otherwise have been deceived into identifying them as somewhat anomalous specimens of *C. Allouia,* with which it is doubtless closely related. The fine stand of plants that we saw, however, did not at all recall that species, so distinctive were they. *C. indecora* is a much taller, stouter plant, and the aspect of the spikes, with their roughly reflexed and spreading bracts and flowers, from which the specific adjective is derived, is quite distinctive amongst the species of the subgenus Pseudophrynium with which I am familiar.

CALATHEA (*Pseudophrynium-Scapifoliae*) **lagunae** Woods. sp. nov. Planta submetralis. Folia brevissime petiolata, lamina late rarissime anguste oblongo-elliptica non raro ovali 11–45 cm. longa 7–12 cm. lata utrinque glabra, petiolo 1.5–6.0 cm. longo tota longitudine calloso minute papillato, vagina 6–15 cm. longa obtusa haud

auriculata glabra. Spica ovoidea 3–6 cm. longa, pedunculo 10–17 cm. longo superne excepto glabro, bracteis ca. 10–15 imbricatis subreniformi-ovatis latissime obtusis vel rotundatis 1–2 cm. longis luteis praecipue basi dense pilosis. Flores ad anthesim ascendentes; ovario 0.2 cm. longo glabro; sepalis oblongo-ovalibus obtusis 2 cm. longis glabris; corollae albae glabrae tubo angusto 2 cm. longo, lobis late ellipticis 1.5 cm. longis, staminibus staminodioque ca. 1 cm. longis.—BOCAS DEL TORO: Western River, Sept. 19, 1941, *von Wedel 2706* (Herb. Missouri Bot. Gard., TYPE); Isla Colón, Oct. 23, 1940, *von Wedel 1328*.

Most closely related to *C. picta* Hook. f. (Bot. Mag. *pl. 7674.* 1899) of previously published species. This Brazilian species, published from a plant cultivated at Kew, however, is stated to be glabrous in all parts, and other discrepancies might be added.

CALATHEA MICROCEPHALA (Poepp. & Endl.) Koernicke, Bull. Soc. Nat. Moscow **35**[1]: 125. 1862 (*Phrynium microcephalum* Poepp. & Endl. Nov. Gen. & Sp. **3**: 20. *pl. 128, figs. a-b.* 1838; *Maranta micans* Mathieu, Cat. 1853; *C. micans* (Mathieu) Koernicke, loc. cit. 126. 1862; *C. albicans* Brongn. ex K. Sch. in Engl. Pflanzenreich **4**[48]: 112. 1902).—I have taken the opportunity to study this species upon several collecting trips to Panama, and have found it to be quite variable in all the key characters used by Petersen and Schumann to separate *C. microcephala, C. micans,* and *C. albicans,* notably height of plant, shape and size of leaves, and color of staminodia. Biologically speaking, I feel quite confident that a single species is represented.

CALATHEA PICTA Hook. f. Bot. Mag. *pl. 7674.* 1899.—COCLÉ: north of El Valle, alt. 1000 m., *Allen 2331*; PANAMÁ: summit of Cerro Campana, alt. 800–1000 m., *Allen 2219.* Mr. C. V. Morton and I can find no characters to separate Mr. Allen's specimens from the illustration of *C. picta.* This is somewhat embarrassing, since the species previously has been known only from a plant, supposedly from Brazil, which was cultivated at Kew.

STROMANTHE LUTEA (Jacq.) Eichl. Abhandl. Akad. Berlin **1882**: 81. 1883. (*Maranta lutea* Jacq. Collect. **4**: 117; Icon. *pl. 201.* 1794; *Myrosma Guapilesense* Donn. Sm. Bot. Gaz. **23**: 251. 1897).—I have been unable to distinguish Capt. Smith's species, ranging from Guatemala to Panama, from that of Jacquin, which occurs in Colombia, Venezuela, and northern Brazil. The former was overlooked by Schumann in his account of Marantaceae for the 'Pflanzen-

reich.' The problem of whether our plant is a *Myrosma* or a *Stromanthe* as applied by Schumann resolves largely into a question of whether the leaves are "antitropic" or "homotropic." This distinction of Eichler appears to me as extremely deceptive, if not artificial, as is shown by Schumann's rearrangement of Eichler's species amongst the same genera, upon the same criterion. I am inclined to disregard this dubious character in favor of others more easy to apply. From the same standpoint, I feel that *Stromanthe Tonckat* (Aubl.) Eichl. is very much better left in *Maranta* where it was placed by Aublet since its entire aspect and structure, exclusive of "homotropic" or "antitropic" orientation of the leaves, is indelibly suggestive of *M. arundinacea* L. *M. Tonckat* has been reported in Costa Rica, and is to be expected in Panama as well.

Myrosma **dasycarpa** (Donn. Sm.) Woods., comb., nov. (*Calathea dasycarpa* Donn. Sm. Bot. Gaz. **31**: 123. 1901; *Ctenanthe dasycarpa* (Donn. Sm.) K. Sch. in Engl. Pflanzenreich, **4**[48]: 153. 1902).—I can scarcely call myself an authority on Marantaceae, and feel a becoming sense of modesty in contradicting the generic concepts of an authority of Dr. Schumann's calibre. Nevertheless, I feel very strongly that several of his generic conceptions amongst the Maranteae in the 'Pflanzenreich' are extremely impractical. Foremost of these, as I have remarked in a previous paragraph, is the distinction between "homotropic" and "antitropic" leaves, of which Schumann even was somewhat wary (Pflanzenreich, loc. cit.). I do not have a large collection of living Maranteae available for observation; but whatever the situation in life, the leaf character is entirely inapplicable in the herbarium, and I am unwilling to perpetuate it in the 'Flora of Panama.' Therefore I am considering *Ctenanthe* Eichl. as a synonym of *Myrosma* L. f. I am not aware of any valid morphological characters to distinguish them.

Ischnosiphon **Pittieri** (Rowlee) Woods., comb. nov. (*Pleiostachya Pittieri* Rowlee, ex Standl. Jour. Wash. Acad. Sci. **15**: 5. 1925).—Since I have made a start toward reforming the genera of Marantaceae as represented in the microcosm of Panama, the job might as well be made consistent. *Pleiostachya* has no observable distinction from *Ischnosiphon* save the compression of the bracts, as far as I am aware; other morphological characters appear to be fairly coherent. Fortunately, the other species currently treated as Pleiostachyas are both provided with combinations in *Ischnosiphon*: *I. pruinosus* (Reg.) Peters., and *I. Morlaei* Eggers.

BURMANNIACEAE

APTERIA APHYLLA (Nutt.) Barnhart—BOCAS DEL TORO: Old Bank Island, Feb. 17, 1941, *H. von Wedel 2111.* Previously known to occur from the southeastern United States to Bolivia.

ORCHIDACEAE

(Louis O. Williams)

HABENARIA MONORRHIZA (Sw.) Reichb. f.—COCLÉ: moist roadside banks, dry hills south of El Valle de Antón, alt. 600–800 m., flowers white, Nov. 13, 1941, *Allen 2771.* A not uncommon species found from Guatemala through Central America, south to Peru and in the West Indies. Apparently not reported for Panama.

SOBRALIA **Allenii** L. O. Williams, sp. nov. (pl. 30, figs. 1–3). Plantae caespitosae, epiphyticae, usque ad 5 dm. altae. Folia elliptico-lanceolata vel anguste elliptica, acuminata, plicata, 7-nervia. Inflorescentia terminalis, uniflora. Sepalum dorsale oblanceolatum, apiculatum. Sepala lateralia lineari-oblonga, apiculata. Petala oblanceolata, acuta, serrulata. Labellum oblongo-ovale, truncatum vel leviter retusum, lacerato-dentatum; discus carinis et callo bipartito ornatus, pubescens. Columna generis.

Caespitose epiphytic plants up to about 5 dm. tall. Stems about 1–2 mm. in diameter, slender, bearing 1–3 leaves toward the apex, leafless below or the leaves reduced to sheaths. Leaves 13–18.5 cm. long, 1.8–2.5 cm. broad, elliptic-lanceolate to narrowly elliptic, acuminate, plicate, with 7 principal nerves, lepidote on the lower surface especially along the nerves at the base, glabrous above or essentially so; leaf-sheaths closely appressed to the stem, lepidote. Inflorescence terminal, 1-flowered, flowers small, white with a pale yellow lip. Dorsal sepal about 3.5 cm. long, 7 mm. broad, oblanceolate, apiculate, 7-nerved. Lateral sepals about 3.5 cm. long, 7 mm. broad, linear-oblong, apiculate, 7-nerved. Petals about 3.5 cm. long, 6–7 mm. broad, oblanceolate, acute, terminal half serrulate, 7-nerved. Lip about 3.5 cm. long, 1.8 cm. broad, oblong-oval, truncate or shallowly retuse, terminal half lacerate-dentate; disc with several inconspicuous longitudinal carinae and with a small bipartite callus thickening at the base, pubescent longitudinally along the middle, especially toward the apex. Column of the genus, about 1.5 cm. long.—COCLÉ: epiphytic, trail to La Mesa, hills north of El Valle de Antón, alt. ca. 1000 m., (sepals and petals white, labellum pale yellow), Aug. 31, 1941, *Allen 2686* (Herb. Ames, TYPE).

Sobralia Allenii is most closely allied to *S. mucronata* A. & S. from which, however, it is distinguished by the pubescent lip which is lacerate-dentate in the terminal half. The leaf-sheaths and leaves of *S. Allenii* are lepidote, while those of *S. mucronata* are glabrous or essentially so.

Description and illustration from a dried specimen and a flower in liquid.

SOBRALIA DECORA Batem. var. **aerata** Allen & Williams, var. nov. (pl. 31). E specie planta parviore et floribus aeratis differt.—COCLÉ: bad lands south of El Valle de Antón, alt. ca. 500 m., Sept. 18, 1941, (flowered in collection of A. M. Bouché, Pedro Miguel, C. Z.), *Allen 2755* (Herb. Ames, TYPE); ravines in bad lands south of El Valle de Antón, alt. ca. 600 m., (flowered in collection of Mr. and Mrs. Barrett, Bas Obispo, C. Z.), *Allen 2846*.

In the field this plant appears to be amply distinct from *Sobralia decora* Batem., but herbarium study indicates that it is perhaps only a variety. The plants average about 5 dm. tall while *S. decora* is commonly 2–2.5 m. tall. The flower color is quite distinctive: sepals greenish on the outer surfaces, very near Brick Red within; petals a washed Brick-Red with lighter margins and median line dorsally; lip Brick Red dorsally with a white median line and white margins, —the inner surface is very nearly Acajou Red with upper margins white and with an Amber Brown median stripe; the column is pure white. [Ridgeway colors]. The local name for this variety is "Bronze Sobralia," hence the varietal name, meaning "ornamented with bronze."

SPIRANTHES **navarrensis** (Ames) L. O. Williams, comb. nov. (*Stenorrhynchus navarrensis* Ames, Sched. Orch. **9**: 13, *t. 3.* 1925).—CHIRIQUÍ: cloud forest, Cerro Horqueta, alt. ca. 2000 m., (flowers yellow), June 2, 1940, *von Hagen & von Hagen 2111*. New to the flora of Panama, previously known from Costa Rica. Closely allied to *Spiranthes speciosa* (G. F. Gmel.) A. Rich.

SPIRANTHES **Woodsonii** L. O. Williams, sp. nov. Herbae palustres, terrestres, usque ad 5.5 dm. altae. Caules graciles, basi foliosi. Folia oblongo-elliptica vel ovalia, acuta vel obtusa. Sepalum dorsale lanceolatum, acuminatum. Sepala lateralia in mentum saccatum producta, lanceolata, acuminata, arcuata. Petala elliptica vel anguste oblanceolata, acuta acuminatave. Labellum lineari-oblongum, panduratum et caudatum, apice leviter expansum. Columna sectionis (§ Sarcoglottis).

Terrestrial, palustrine herbs from underground rhizomes, up to

5.5 dm. tall. Rhizome slender, rooting at most of the nodes, with scarious sheaths arising from the nodes. Stem slender, with well-developed leaves at the base which become bract-like above. Leaves 3–10 cm. long, 1.3–2.8 cm. broad, oblong-elliptic to narrowly oval, acute or obtuse, largest near the base of the stem and reduced to amplexicaul bracts above. Inflorescence up to 10 cm. long, congested in flower, becoming more open in fruit; bracts up to 4 cm. long, 1.6 cm. broad, lanceolate, acuminate, pubescent dorsally. Flowers large, similar to those of *S. acaulis*. Dorsal sepal 16.5–19 mm. long, 3.5–4 mm. broad, lanceolate, acuminate, 3–5-nerved, densely pubescent dorsally. Lateral sepals long-decurrent on the ovary, 35–40 mm. long from the apex to the base of the saccate mentum; free part 16.5–19 mm. long, 4–4.5 mm. broad, lanceolate, acuminate, arcuate, spreading, densely pubescent dorsally, 3–5-nerved. Petals 15–18 mm. long, 2–2.5 mm. broad, narrowly elliptic to narrowly oblanceolate, acute or acuminate, arcuate, adherent to the dorsal sepal, pubescent on the margins, the basal half ciliate. Lip 28–32 mm. long, 6–7 mm. broad (apical lobe), linear-oblong, caudate, somewhat expanded and pandurate, with two extremely pubescent, converging callus-ridges on the terminal third, the basal part densely pubescent and the remainder, except the glabrous apex, less pubescent, glabrous below except at the base; terminal lobe transversely oval or transversely rhombic; caudae about 5 mm. long, retrorse, fleshy but flattened. Column (free part) about 8 mm. long, pubescent at the base ventrally; rostellum oblong-lanceolate, obtuse, flattened. Ovary densely pubescent.—CHIRIQUÍ: vicinity of Boquete, alt. 1200-1500 m., (flowers pale green), July 24-26, 1940, *Woodson & Schery 753* (Herb. Ames, TYPE); in swampy meadows, Finca Lérida to Boquete, alt. ca. 1300-1700 m., (flowers pale yellowish green), July 8–10, 1938, *Woodson, Allen & Seibert 1148*.

Spiranthes Woodsonii is not very closely allied to any Central American species of the genus. It belongs in the section Sarcoglottis. The species is particularly distinctive in having a creeping underground rhizome or stem instead of the usual fascicle of fleshy roots. In flower structure *Spiranthes Woodsonii* approaches *S. acaulis* (J. E. Sm.) Cogn. *(S. picta* (Anders.) Lindl.) but in detail is amply distinct.

STELIS **Allenii** L. O. Williams, sp. nov. (pl. 32, figs. 1–3). Herbae caespitosae, epiphyticae, usque ad 4 dm. altae. Folia elliptica vel elliptico-ovalia, acuta vel obtusa. Inflorescentia elongata; bracteae ovato-lanceolatae, acutae vel acuminatae, infundibuliformes. Sep-

alum dorsale lanceolatum, acutum, cucullatum. Sepala lateralia connata, suborbiculari-ovata, acuta vel obtusa, cucullata et gibbosa. Petala late flabellata vel transverse ovalia. Labellum flabellatum, truncatum, apice callo transverso ornatum.

Large caespitose epiphytic herbs up to 4 dm. tall. Secondary stems 7–15 cm. long, 0.25–0.35 cm. in diameter, covered with 2 or 3 loose sheaths which soon disintegrate, shorter than the leaves. Leaves 10–19 cm. long, 3.5–7 cm. broad, elliptic to elliptic-oval, acute or obtuse, coriaceous, attenuated into a short petiole at the base. Inflorescence up to 30 cm. long, floriferous to the base, 1 or more borne from the apex of the stems (if more than 1 then presumably borne in different years); sheaths up to 2.5 cm. long, cucullate, ample; bracts 2–18 mm. long, reduced upward, ovate-lanceolate, acute or acuminate, infundibuliform. Flowers largest of the genus. Dorsal sepal 14–16 mm. long, 5–6 mm. broad, lanceolate, acute, 11–13-nerved, cucullate. Lateral sepals connate to their apices, together 10–12 mm. long and 8–10 mm. broad, suborbicular-ovate, acute or obtuse, cucullate and gibbous at the base, many-nerved. Petals about 1 mm. long, 1.5 mm. broad, broadly flabellate to transversely oval, the apex much thickened. Lip 0.75–1 mm. long, 1–1.4 mm. broad, about 0.75 mm. thick at the apex, flabellate, truncate, with a transverse callus at the apex of the lip,—very like the petals but slightly smaller.—COCLÉ: hills north of El Valle de Antón, alt. 800 m., (flowers nearly black), April 10, 1942, *Allen 2952* (Herb. Ames, TYPE).

Stelis Allenii is perhaps the most distinctive species of this difficult genus in Central America and seems to be the largest-flowered species of the genus. There are no near allies in Central America but the species seems to belong to Lindley's section Dialissa, a section with but a few species in the Andes.

STELIS **atrorubens** L. O. Williams, sp. nov. (pl. 32, figs. 4–8). Herbae epiphyticae, caespitosae, parvae, usque ad ca. 18 cm. altae. Folia petiolata; lamina elliptica vel elliptico-oblanceolata, obtusa. Inflorescentia densiflora, quam folia longiora. Sepala basi connata, rotata, triangularia, acuta. Petala suborbicularia, carnosa. Labellum obscure trilobatum, oblongum vel oblongo-ovale, carnosum.

Small caespitose epiphytic herbs up to about 18 cm. tall. Secondary stems 1.5–3.5 cm. long, slender, covered with sheaths. Leaves 6–9 cm. long, petiolate, much longer than the secondary stems; lamina about 4–6.5 cm. long, 0.5–1 cm. broad, elliptic to elliptic-oblanceolate, obtuse, fleshy; petiole 2–3 cm. long. Inflorescence up

to 15 cm. long, upper half more or less densely flowered; bracts about 2 mm. long, infundibuliform, acute, scarious. Sepals connate at the base, rotate, 2–2.5 mm. long, 1.5–2 mm. broad, triangular, acute, 3-nerved. Petals about 0.75 mm. long, 0.75 mm. broad, suborbicular, 1-nerved, the terminal part thickened, fleshy. Lip 1–1.5 mm. long, 0.5–0.6 mm. broad, obscurely 3-lobed, oblong or oblong-oval, basal part of the lip oblong, somewhat concave, fleshy, terminating into two small, suberect lateral lobes,—terminal lobe of the lip about 0.5 mm. long, suborbicular, strongly concave, fleshy.—COCLÉ: vicinity of El Valle, alt. 600–1000 m., Dec. 8, 1938, *Allen 1234;* hills north of El Valle de Antón, trail to Las Minas, (flowers maroon), Dec. 2, 1941, *Allen 2876* (Herb. Ames, TYPE).

Stelis atrorubens is allied to *S. montana* L. Wms., but differs in several details. The flower parts of *S. montana,* a species not previously illustrated, are figured in pl. 32, figs. 9–12, for comparison.

STELIS MONTANA L. Wms. in Ann. Mo. Bot. Gard. **27**: 272. 1942.—Figures of this distinctive and unusual species are given in pl. 32, figs. 9–12.

CRYPTOPHORANTHUS **lepidotus** L. O. Williams, sp. nov. (pl. 30, figs. 4–7). Herbae caespitosae, epiphyticae, usque ad ca. 17 cm. altae. Folia oblanceolata vel anguste obovata, obtusa vel acuta, coriacea, petiolata. Sepala basi et apice connata; sepalum dorsale oblongo-oblanceolatum, cucullatum, carnosum; sepala lateralia usque ad apicem connata. Petala late ovato-lanceolata, acuta vel acuminata. Labellum hastatum, unguiculatum; lamina verrucosa vel lepidota. Columna generis.

Caespitose epiphytic herbs up to about 17 cm. tall. Secondary stems 2–7 cm. long, 1–2 mm. in diameter, covered with 4–5 pergameneous, infundibuliform sheaths which soon disintegrate. Leaves oblanceolate to narrowly obovate, obtuse or acutish, coriaceous, contracted into a distinct petiole; lamina 3.5–10 cm. long; petiole 1–2 cm. long, conduplicate. Inflorescence a fascicle of 1–6 long pedunculate flowers at the apex of the secondary stem; the peduncle with 1–3 short infundibuliform sheaths. Sepals joined at the base and at the tip leaving a small opening between the dorsal and lateral sepals; dorsal sepal about 15–20 mm. long, 6–7 mm. broad, oblong-oblanceolate, strongly cucullate, fleshy, 7-nerved, ridged dorsally, the ridges verrucose; lateral sepals connate to their apices, about 12–18 mm. long and together 6–8 mm. broad, fleshy, each about 7-nerved, with verrucose ridges dorsally. Petals 5–6 mm. long, 2.5–3.5 mm. broad, broadly ovate-lanceolate, acute or acuminate,

3(–5)-nerved. Lip 5–6 mm. long, the lamina about 4 mm. long, 1.5–2 mm. broad, hastate, unguiculate, 3-nerved, verrucose or lepidote, with two longitudinal, lamellate calluses extending from the auricles to about the middle; auricles about 1 mm. long, retrorse, subulate; claw 1.5–2 mm. long, 1–1.5 mm. broad, verrucose-scurfy or lepidote toward its apex. Column of the genus.—COCLÉ: epiphytic, trail to Las Minas, hills north of El Valle de Antón, alt. ca. 1000 m., (lower sides of many of the leaves deep purple, flowers white with very heavy purple stripes), Sept. 1, 1941, *Allen 2718* (Herb. Ames, TYPE).

Cryptophoranthus lepidotus is apparently somewhat allied to *C. beloglottis* Schltr. from Ecuador but it is easily distinguished by the smaller, differently shaped leaves as well as by the details of the flowers. *Cryptophoranthus Endresianus* Kränzl. is not well described but the available record indicates that it differs from *C. lepidotus*. Kränzlin's monograph of *Cryptophoranthus* (in Fedde Repert. Beih. **34**: 220–232. 1925) omits several species of this genus published prior to the date of the monograph.

LEPANTHES LINDLEYANA Oerst. & Reichb. f.—This name has been taken up for a not-uncommon species of Costa Rica and Panama. Reichenbach illustrated the species but his illustration does not coincide too well with the plants referred here. The plant usually identified as *L. Lindleyana* has a name which seems to refer to it exactly, *Lepanthes chiriquensis* Schltr. In the original description of *L. Lindleyana* the petals are described as "Tepala dimidiata triangula angulo inferiori obtusata, ciliolata," and in the illustration the petals might be considered to fit this characterization rather loosely. The petals, if bipartite, have a large anterior lobe and no posterior lobe; the dorsal sepal is as broad as the combined laterals; the lip shows no apiculation or mid-lobe.

PLEUROTHALLIS **antonensis** L. O. Williams, sp. nov. Herbae caespitosae, epiphyticae, usque ad 3 dm. altae. Folia lanceolato-cordata vel late cordata, acuta vel acuminata, coriacea. Inflorescentia fasciculata, uni- vel pauciflora. Sepalum dorsale elliptico-obovatum, obtusum vel acutum. Sepala lateralia connata, ovata vel late ovata, obtusa vel acuta. Petala lineari-oblonga, acuta, serrulata, arcuata. Labellum unguiculatum; lamina cordata vel oblongo-cordata, denticulata; unguis brevis. Columna generis.

Caespitose epiphytic herbs up to about 3 dm. tall. Secondary stems slender, with one or two scarious sheaths at the base, naked above. Leaves 4–9 cm. long, 1.5–4.7 cm. broad, lanceolate-cordate to

broadly cordate (young leaves elliptic), acute or acuminate, coriaceous. Inflorescence a 1–several-flowered fascicle from the apex of the secondary stems, much shorter than the subtending leaves. Dorsal sepal 6–7.5 mm. long, 3–4 mm. broad, elliptic-obovate, obtuse or acute, 3-nerved. Lateral sepals connate to their apices, 5.5–7 mm. long, 4–5 mm. broad, ovate or broadly ovate, obtuse or acute, 6-nerved. Petals 3.8–4.5 mm. long, 0.6–1 mm. broad, linear-oblong, acute, serrulate, strongly arcuate, 1-nerved. Lip unguiculate; lamina 2.5–3 mm. long, 2–2.5 mm. broad, cordate to oblong-cordate, denticulate, fleshy, the surface obscurely verrucose or smooth, with a small central cavity near the base; claw short. Column about 1 mm. long.—COCLÉ: hills north of El Valle de Antón, alt. ca. 1000 m., (flowers light brown), July 23, 1940, *Allen 2156;* same locality, July 14, 1940, *Allen 2194;* same locality, Nov. 21, 1940, *Allen 2267;* same locality, Sept. 1, 1941, *Allen 2701* (Herb. Ames, TYPE); mountains beyond La Pintada, alt. 400–600 m., Feb. 17, 1935, *Hunter & Allen 594.*

Pleurothallis antonensis has been referred to *P. phyllocardia* Reichb. f., a rather obscure and poorly described species. We have an analysis of *P. phyllocardia* which shows the lip to be about one-fourth the length of the lateral sepals, while in *P. antonensis* the lip is half as long as the sepals. The lateral sepals of *P. phyllocardia* are about as broad as the dorsal sepal and the petals are only slightly arcuate, while in *P. antonensis* the lateral sepals are broader than the dorsal sepal and the petals are strongly arcuate.

The specific name recalls El Valle de Antón which, apparently, has a very large number of endemic species of orchids.

PLEUROTHALLIS ARISTATA Hook. in Ann. & Mag. Nat. Hist. **2**: 229, *t. 15.* 1839. *(P. dichotoma* Ames, Sched. Orch. **6**: 58. 1923, non Schltr.; *P. divexa* Ames. Sched. Orch. **7**: 20, *t. 5.* 1924).

Costa Rica, Panama, the West Indies and British Guiana.

Pleurothallis Urbaniana Reichb. f. has been considered to be the same as the two synonyms cited (Schweinfurth in Bot. Mus. Leafl. Harv. Univ. **6**: 36. 1938) but no authentic material or record is available and the description shows some discrepancies. Known only from Chiriquí in Panama *(Davidson 187).*

PLEUROTHALLIS BRIGHAMII S. Wats. in Proc. Am. Acad. **23**: 285. 1888; Ames, Sched. Orch. **2**: 18. 1923; **7**: 19, *t. 7.* 1924. *(P. periodica* Ames, Sched. Orch. **7**: 21, *fig. 4.* 1924; *P. acrisepala* A. & S. Sched. Orch. **8**: 22. 1925; *P. barboselloides* Schltr. in Fedde Repert. Beih. **17**: 18. 1922; **59**: *t. 29, fig. 113.* 1931).

In attempting to separate and describe the various species cited above for the account of the Panamanian flora it was found that, as a whole, they formed a most complete series.

Pleurothallis pyrosodes Reichb. f. is of this alliance. It is known to me only by the description and a rather rough analysis of the type but it may prove to be the same and if so it will include all of the above names as synonyms. *Pleurothallis Brighamii,* as now constituted, is a species of low elevations, perhaps not exceeding 400 m., which extends from Guatemala to Panama.

PLEUROTHALLIS **cardiochila** L. O. Williams, sp. nov. (pl. 33, figs. 8–10). Herbae caespitosae, epiphyticae, usque ad ca. 21 cm. altae. Folia lanceolato-cordata, acuminata, coriacea. Inflorescentia fasciculata, uni(–pauci)-flora. Sepalum dorsale oblongo-ovale, obtusum, cucullatum. Sepala lateralia connata, ovata, acuta. Petala linearioblonga, acuta, basi subauriculata. Labellum unguiculatum; lamina suborbiculari-cordata, obtusa; unguis oblongus. Columna generis.

Small caespitose epiphytic herbs up to about 21 cm. tall. Secondary stems up to about 11 cm. long, slender, with 1–2 loose, chartaceous sheaths toward the base, naked above. Leaves 9–10 cm. long, 3.6–3.9 cm. broad, lanceolate-cordate, acuminate, coriaceous. Inflorescence a 1(–few ?)-flowered fascicle subtended by a chartaceous sheath about 1–1.5 cm. long, much shorter than the leaves. Flowers very large for the group, yellowish with the dorsal sepal tinged with dark red, lip deep orange. Dorsal sepal about 20 mm. long, 12.5 mm. broad, oblong-oval, obtuse, with 7–9 principal nerves, strongly cucullate. Lateral sepals connate to their apices, about 18 mm. long, 10 mm. broad, ovate, acute, with 7–9 principal nerves. Petals about 13 mm. long, 2.5 mm. broad, linear-oblong, acute, arcuate, subauriculate on the posterior margin at the base, entire, 3-nerved at the base, the posterior nerve short, anterior nerve branched near the base,—hence the apical part of the petal 3-nerved. Lip unguiculate; lamina about 6 mm. long, 5.5 mm. broad, suborbicular-cordate, obtuse, callus-thickened along the sinus and below at the subapiculate apex, 3-nerved; claw about 2 mm. long, oblong. Column about 3 mm. long; clinandrium lacerate-digitate.—CHIRIQUÍ: rain forest, Bajo Chorro, Boquete District, alt. ca. 1800 m., Jan. 13, 1938, *Davidson 119* (Herb. Ames, TYPE).

Pleurothallis cardiochila is most nearly allied to *P. palliolata* Ames, from which it is easily distinguished by the suborbicular-cordate lip and by the 3-nerved, entire petals.

PLEUROTHALLIS **ellipsophylla** L. O. Williams, sp. nov. (pl. 33, figs. 1–7). Herbae parvae, repentes vel caespitosae, usque ad 2 dm. altae. Folia late elliptica vel elliptico-oblonga, acuta vel obtusa. Inflorescentia uni- vel pluriracemosa, racemis quam folia brevioribus. Sepalum dorsale anguste lanceolatum vel elliptico-oblanceolatum, acutum vel acuminatum. Sepala lateralia in laminam connata; lamina lanceolata, acuta vel subaristata. Petala elliptica vel elliptico-lanceolata, acuta vel acuminata, prope medium denticulata vel denticulato-lacerata. Labellum lanceolatum, acutum vel subaristatum, basi biauriculatum; unguis perbrevis; lamina prope basem callo V-formi ornata.

Small repent or caespitose epiphytic herbs up to about 2 dm. tall. Secondary stems up to 9.5 cm. long, prominently angled when dry, with one or more loose sheaths covering the lower part. Leaves 4–9.5 cm. long, 0.7–2.7 cm. broad, elliptic to elliptic-oblong, acute or obtuse, epetiolate, coriaceous. Inflorescence 1 or several short, few-flowered racemes from the axil of the leaf, approximately half as long as the leaf. Dorsal sepal 9–14 mm. long, 1.5–2.5 mm. broad, narrowly lanceolate to elliptic-oblanceolate, acute or acuminate, cucullate, 3-nerved, puberulent dorsally. Lateral sepals 10–13 mm. long and together 3–4 mm. broad, connate except at the tip, the lamina lanceolate, acute or subaristate, puberulent dorsally, gibbous and with a mentum at the base, 6-nerved. Petals 5.5–6.5 mm. long, 1.4–2 mm. broad, elliptic or elliptic-lanceolate, acute or acuminate, arcuate, denticulate or denticulate-lacerate toward the middle but the base and apex usually entire, 1-nerved. Lip 4–5 mm. long and 1–1.3 mm. broad, lanceolate, acute or subaristate, somewhat fleshy, prominently biauriculate at the base, claw very short, lamina with an inconspicuous V-shaped callus on the basal third. Column about 3 mm. long, with a narrow wing and two erect teeth at the apex; column-foot very short.—BOCAS DEL TORO: epiphyte, southwest of Bocas at Maccaw Hill, Isla Colón, alt. 0–125 m., (flowers greenish-brown), Aug. 25, 1940, *H. von Wedel 560* (Herb. Ames, TYPE); Río Cricamola, between St. Louis and Konkintöe, alt. ca. 10–15 m., ("labellum and hood greenish-yellow, striped with brown"), Aug. 12–16, 1938, *Woodson, Allen & Seibert 1884.*

Pleurothallis ellipsophylla is allied to *P. vittata* Lindl. and to *P. geminicaulina* Ames. From the former it is distinguished by larger flowers with comparatively narrow lip which lack lateral auricles or lobes; from *P. geminicaulina* it is distinguished by the compara-

tively longer and narrower lip with more prominent basal auricles, but lacks the parallel carinae of the lamina.

PLEUROTHALLIS OCTOMERIAE Schltr. in Fedde Repert. Beih. **17**: 21. 1922. *(P. cerea* Ames, Sched. Orch. **4**: 19. 1923; **7**: 26, *fig. 4* and *t. 8* in part. 1924).—COCLÉ: epiphytic, hills north of El Valle de Antón, trail to Las Minas, alt. ca. 1000 m., (sepals and petals pure white with narrow bright red margin, anther-cap red), Sept. 1, 1941, *Allen 2719.*

Pleurothallis octomeriae and *P. cerea* have flowers that are identical but the leaves on the types of the two species differ markedly in size, those of *P. octomeriae* varying from 4 to 14 cm. long and from 1 to 2.5 cm. broad while the single imperfect leaf known for *P. cerea* is "17 cm. or more long, 6.3 cm. wide." In both the shape of the leaf is essentially elliptic. In the collection cited above *(Allen 2719),* of which there are four excellent specimens, the extremes of leaf sizes are 8 and 17 cm. long and 1.7 and 6 cm. broad. This indicates that the leaf size in the two proposed species is not specific and that they should be treated as one.

EPIDENDRUM PHYSODES Reichb. f.—BOCAS DEL TORO: terrestrial, vicinity of Chiriquí, Oct. 9, 1940, *H. von Wedel 1126.* New to Panama, previously known from Mexico, Guatemala and Costa Rica.

CATTLEYA SKINNERI Batem. var. **autumnalis** P. H. Allen, var. nov. Herbae epiphyticae vel saxicolae. Labellum concolor vel subconcolor. E specie planta robustior et floribus in autumno differt.

Differs from the species in that it is a somewhat more robust plant which flowers in the autumn. The lip usually lacks the white spot.—PANAMÁ: vicinity of Bejuca, alt. ca. 30 m., Aug. 15, 1941, *Allen 2668* (Herb. Ames, TYPE); east of [Panama] City, fall 1915, *Powell 16;* CANAL ZONE: along Caño Quebrada, Oct. 30, 1914, *Pittier 6828.*

Endemic to Panama where the species, a plant of higher elevations, does not occur (unless possibly in the mountains of Chiriquí).

Platyglottis L. Wms. gen. nov.

Platyglottis L. O. Williams gen. nov. (Orchidaceae-Monandrae-Acrotonae-Kerosphaereae-Acranthae-Ponereae). Herbae epiphyticae, caespitosae, e rhizomate perbrevi. Caules graciles, non pseudobulbosi, indurati, simplices. Folia disticha, coriacea. Inflorescentia terminalis (vel subterminalis ?), racemosa. Sepala petalis

subaequalia vel petala latiora. Labellum apice columnae pedi articulatum; lamina late ligulata, integra. Columna brevis, clavellata, exalata, basi in pedem brevem producta; anthera terminalis, operculata, incumbens, sex-loculata; pollinia 6($\frac{00}{0000}$), aequalia cerea.

Epiphytic caespitose herbs from a very short rhizome. Stems slender, non-pseudobulbous, indurated, simple. Leaves alternate, distichous, coriaceous, plane, deciduous, leaf-sheaths tightly enfolding the stem. Inflorescence terminal (or subterminal?), racemose. Sepals subequal; dorsal sepal free; lateral sepals adnate to the short column-foot at their bases and with it forming an inconspicuous mentum. Petals similar to the sepals or broader. Lip articulated to the apex of the column-foot; lamina broadly ligulate, entire. Column short, clavellate, wingless, produced into a short foot at the base; anther terminal, operculate, incumbent, 6-loculate; pollinia 6, equal,—four basal in one laterally compressed series,—two terminal in a second laterally compressed series, ceraceous.

A single species known only from the vicinity of El Valle de Antón, Coclé Province, Panama.

The Ponereae is a small tribe of orchids the genera of which are limited to the American tropics or subtropics. The twelve genera of the tribe which seem to be recognizable are, with one exception, small with about six or fewer species each. Vegetatively these genera are divisible into two approximately equal series: (1) those with elongated stems and distichous leaves scattered along the stem; and (2) those with swollen or pseudobulbous stems upon which the leaves are terminal. These two groups may be further divided by various means.

The Brazilian genus *Orleanesia* Rodr., which I know only from a plate and descriptions, seems to approach *Platyglottis* in vegetative characters more than do the other genera of the tribe. Thus *Orleanesia,* which has two small and two large pollinia and apparently other technical characters, is easily separated from *Platyglottis.*

The other genera which approach *Platyglottis* in vegetative characters, *Jacquiniella* Schltr., *Ponera* Lindl., *Neourbania* Fawc. & Rendle, *Isochilus* R. Br. and *Octadesmia* Benth., may be quickly distinguished by the technical characters of the pollinia,—all having four pollinia except *Octadesmia* which has eight. *Platyglottis* is the only genus of this alliance which has six pollinia. However, six pollinia are not uncommon in the genus *Scaphyglottis* Poepp. &

Endl. *(sens. lat.)* which belongs in the series of the tribe having thickened stems or pseudobulbs.

PLATYGLOTTIS **coriacea** L. O. Williams, sp. nov. (pl. 34). Herbae epiphyticae, caespitosae, usque ad ca. 4.5 dm. altae. Folia anguste ligulata, obtusa, coriacea. Inflorescentia racema brevis, pauciflora. Sepalum dorsale lanceolatum, acutum vel acuminatum. Sepala lateralia lanceolata, acuta vel acuminata, leviter obliqua. Petala elliptico-oblanceolata, leviter obliqua. Labellum late ligulatum, subpanduratum, integrum, apice rotundatum. Columna generis.

Epiphytic caespitose herbs up to about 4.5 dm. tall. Stems 5–8 mm. in diameter, slender, leafy, becoming naked with age. Leaves 2.5–6 cm. long, 1–1.5 cm. broad, narrowly ligulate, obtuse, obscurely and unequally bilobed at the apex, coriaceous, distichous, deciduous. Inflorescence a short, few-flowered raceme, terminal (or subterminal?); bracts 7–20 mm. long, elliptic-lanceolate, acute, cucullate. Flowers large for the Ponereae, sepals and petals lavender, the lip lavender with greenish margins. Dorsal sepal about 10 mm. long, 3.5 mm. broad, lanceolate, acute or acuminate, 5(–7)-nerved. Lateral sepals about 10 mm. long, 3 mm. broad, lanceolate, acute or acuminate, slightly oblique, 5-nerved. Petals about 10 mm. long, 3.5 mm. broad, elliptic or elliptic-oblanceolate, somewhat oblique, obscurely constricted near the apex, 5(– 7)-nerved. Lip about 10 mm. long and 5 mm. broad near the apex, broadly ligulate, subpandurate, entire, apex rounded, margins thin and plicate laterally; disc fleshy, with a pair of inconspicuous, subumbonate calluses at the base. Column of the genus, about 4 mm. long.—COCLÉ: region north of El Valle de Antón, alt. ca. 1000 m., Feb. 20, 1942, *Allen 2936* (Herb. Ames, TYPE).

Described and illustrated from a herbarium specimen and flowers preserved in alcohol.

COELIOPSIS HYACINTHOSMA Reichb. f.—COCLÉ: epiphytic, hills north of El Valle de Antón, alt. ca. 1000 m., (inflorescence pendant, sepals and petals creamy white, labellum creamy white with yellow blotch near base of column), April 12, 1941, *Allen 2402*.

The original specimens were grown in England from material presumed to have been collected in Panama. Three collections, at least, have been made subsequently in Costa Rica but this is the first specimen known from a definite locality in Panama.

KEGELIELLA **Houtteana** (Reichb. f.) L. O. Williams, comb. nov. *(Kegelia Houtteana* Reichb. f. in Bot. Zeit. **10**: 670. 1852; Xenia

Orch. **1**: 45, *t. 20, I, 1–7.* 1854).—COCLÉ: vicinity of La Mesa, region north of El Valle de Antón, alt. 1000 m., Oct. 10, 1941, *Allen 2759.*

Kegeliella is a genus so extremely rare that but a single specimen previously had ever been received at the Ames Herbarium, and that from Jamaica. Mansfeld (Fedde Repert. **36**: 60. 1934) described an additional species of the genus from Costa Rica and called attention to the fact that *Kegelia* Reichb. f. was a homonym. It is apparent from Mansfeld's discussion that the genus was unrepresented in the Berlin herbarium until he received that specimen.

Kegeliella Houtteana was originally described from garden material that was said to have been discovered in Surinam. In repeating his description two years later in 'Xenia Orchidacea' Reichenbach wrote "Es ist sehr wahrscheinlich, dass die Mutterpflanze—von der Tracht einer Cirrhaea—aus Surinam stammt und von Herrn Kegel entdeckt wurde," which may indicate that he has some reason to doubt his previous statement of locality.

Reichenbach's drawing of his *Kegelia Houtteana,* like so many of his drawings, shows enough to recognize the genus but is not definite enough for one to be able to state that a specimen in hand is, without doubt, conspecific. There are some differences in the flowers of the Allen specimens and the only other specimen available (Jamaica, *Skinner & Robinson 7432)* but until more material is available and Reichenbach's type is better understood it is perhaps better not to try to separate the two.

The genus is new to Panama.

MAXILLARIA ARACHNITIFLORA A. & S.—COCLÉ: epiphytic; trail to Las Minas, hills north of El Valle de Antón, alt. 1000 m., Dec. 2, 1941, *Allen 2875.* Previously known from Costa Rica where it is rare. The present specimen is smaller than the type specimen.

MAXILLARIA **conduplicata** (A. & S.) L. O. Williams, comb. nov. *Ornithidium conduplicatum* A. & S., Sched. Orch. **8**: 66, *fig.* 1925).—CHIRIQUÍ: Palo Alto Hill, alt. 1300–1600 m., Sept.-Oct. 1923, *Powell 341.* Known only from Panama.

MAXILLARIA ENDRESII VAR. ANGUSTISEGMENTA (A. & S.) C. Schweinf. —COCLÉ: hills north of El Valle de Antón, alt. 1000 m., Dec. 2, 1941, *Allen 2870.*—Previously known from Costa Rica. The present specimen has blunter sepals and petals than usual and the peduncles are shorter.

MAXILLARIA **neglecta** (Schltr.) L. O. Williams, comb nov. *(Ornithidium anceps* Reichb. f., Beitr. Orch. Centr.-Am. 75. 1866, non *Maxillaria anceps* A. & S.; *O. neglectum* Schltr. in Fedde Repert. **19**:

242. 1923).—CANAL ZONE: on trees, hills north of Frijoles, Dec. 19, 1923, *Standley 27669;* CHIRIQUÍ: epiphyte in shade; valley of Upper Río Chiriquí Viejo, alt. 1300–1900 m., July-Aug. 1937, *White & White 37.* The species is quite a common one and extends from Honduras to Panama.

MAXILLARIA **Pittieri** (Ames) L. O. Williams, comb. nov. *(Ornithidium Pittieri* Ames, Sched. Orch. **2**: 35. 1923).—CHIRIQUÍ: rain forest, Bajo Chorro, Boquete District, alt. ca. 2000 m., *Davidson 117.* Costa Rica and Panama.

CRYPTOCENTRUM CALCARATUM Schltr. in Fedde Repert. **12**: 214. 1913. *(Pittierella calcarata* Schltr. l.c. **3**: 81. 1906).—COCLÉ: region north of El Valle de Antón, alt. ca. 1000 m., (flowered at Ancon, C. Z.), Nov. 5, 1941, *Dunn 2762.* This is the third species of *Cryptocentrum* to be found in Panama recently. Previously known from Costa Rica where it is not uncommon.

TRICHOPILIA TURIALBAE Reichb. f.—VERAGUAS: epiphytic; mountains west of Azuero, alt. 600 m., (flowered in collection of Mr. A. G. B. Fairchild), Sept. 10, 1941, *Dunn s.n.*—Previously known from Costa Rica. *Trichopilia turialbae* is allied to *T. tortilis* Lindl. and seems to be distinguished by its smaller, differently colored flowers with lateral sepals connate to about the middle. The sepals and petals are 3 cm. long in our specimen, while the lip is 4 cm. long. The sepals and petals of the type of *T. turialbae,* of which we have a photograph, are nearly as long as the lip.

MESOSPINIDIUM WARSCEWICZII Reichb. f. in Bot. Zeit. **10**: 929. 1852; Xenia Orch. **1**: 36, *t. 16, figs. I, 1–11.* 1854.—COCLÉ: epiphyte; El Valle de Antón, alt. 650 m., (sepals and petals greenish yellow spotted maroon, lip pale yellow with minute red spots; flowered at San Francisco de la Calita), Aug. 30, 1941, *A. G. B. Fairchild (Allen 2685).* Apparently the first collection of this species since the original was made some ninety years ago.

The determination has been made on the basis of the original description and figures I and 1 cited above. Figure 1 is exactly like the plant in hand, and figure I is fairly good; figures 4 and 5 are erroneous and misleading; the remainder of the figures are fairly good.

The generic status of the plant is open to some question. It is very close to *Odontoglossum* and especially to Lindley's group *"Myanthium,"* an aggregation of small-flowered species not unlike *Mesospinidium* in habit and flower structure. However, in *Mesospinidium Warscewiczii* there seems to be a short but distinct col-

umn foot and, consequently, a mentum. These conditions are not known to me to occur in *Odontoglossum*.

LOCKHARTIA MICRANTHA Lindl.—COCLÉ: region north of El Valle de Antón, alt. ca. 1000 m., Jan. 13, 1942, *Allen 1942*. This collection is peculiar because of the very short lateral lobes of the lip, in this case almost lacking. *Lockhartia integra* A. & S. is probably a synonym.

DICHAEA MORRISII Fawc. & Rendle.—COCLÉ: epiphytic; trail to Las Minas, hills north of El Valle de Antón, alt. ca. 1000 m., (sepals and petals striped with deep lavendar, lip deep lavendar), Dec. 2, 1941, *Allen 2874*. Previously known from the Costa Rica and the West Indies.

CHLORANTHACEAE

HEDYOSMUM NUTANS Sw.—BOCAS DEL TORO: Fish Creek Mts., Apr. 29, 1941, *H. von Wedel 2362*.—Known from the West Indies. Judging from the original description of *H. Brenesii* Standl. (Fl. Costa Rica, p. 371), that species may be synonymous with *H. nutans*. There seems to be no valid distinction between the von Wedel specimen and West Indian plants determined as *H. nutans*, and no justification in assuming a plant to be different from West Indian species merely because it is found on the Central American mainland.

LACISTEMACEAE

LOZANIA KLUGII Mansf.—BOCAS DEL TORO: Old Bank Island, Feb. 18, 1941, *H. von Wedel 2121*.—Previously known from Colombia and Peru. No specimens of *L. pedicellata* (Standl.) L. B. Smith were available for comparison, but in the von Wedel specimen the racemes are not always solitary in the leaf axils, the character separating *L. pedicellata* in Smith's key (Phytologia **1**: 138. 1935) from the *L. Klugii* group. The specimen agrees well with South American specimens of *L. Klugii*. This genus has also been included in the Flacourtiaceae by many systematists.

MORACEAE

(P. C. Standley)

PEREBEA **hispidula** Standl., sp. nov.—Ramuli gracillimi brunnescentes vel ochracei dense hispiduli vel fere hirsuti, internodiis elongatis; stipulae caducae lineares ca. 1.5 cm. longae extus hirsutae; folia majuscula brevissime petiolata membranacea, petiolo crasso hirsuto vix ultra 4 mm. longo; lamina oblonga vel elliptico-oblonga

14–23 cm. longa 4.5–8 cm. lata caudato-acuminata, acumine angusto interdum fere lineari usque 2 cm. longo, basi paullo inaequali anguste rotundata vel obtusissima, remote saltem supra medium serrato-denticulata, supra sublucida ad costam sparse hirsuta aliter glabra, subtus paullo pallidior ad costam nervosque hispidula vel hirsuta ad venas puberula et in areolis minute scaberulo-asperata, costa tenui prominente, nervis lateralibus utroque latere ca. 16 angulo lato divergentibus leviter arcuatis prope marginem arcuato-conjunctis, venis prominulis laxe reticulatis; receptaculum femineum axillare fere sessile in statu fructifero 2 cm. latum, bracteis paucis imbricatis inaequalibus latis obtusis vel apiculatis, interioribus vix ultra 4 mm. longis, omnibus extus dense albido-strigosis; drupae ca. 8 sessiles ovali-globosae ca. 7 mm. longae et 5–6 mm. latae apice basique rotundatae, ubique dense hispidulae; stylus crassus cum ramis vix 1 mm. longus, ramis stylo brevioribus crassis acutis.—BOCAS DEL TORO: vicinity of Chiriquí Lagoon, *H. von Wedel 1935* (Herb. Missouri Bot. Gard. TYPE).

In leaves and inflorescence this tree, of somewhat doubtful generic position, is quite unlike any species of *Perebea* that has been recorded from Central America, and it is not very closely related to any of the South American ones of which material is available. Probably it is referred correctly to *Perebea,* but further material will be necessary to decide this point, the available specimens being unfortunately rather inadequate and incomplete.

CAPPARIDACEAE

CAPPARIS **clara** Schery, sp. nov. Arbuscula 5 m.; ramulis novellis aureobrunneis cum squamis minutis peltatis stellatis, internodiis ca. 2 cm. longis; foliis alternatis ellipticis basi acutis apice attenuatissime mucronatis, petiolis brevibus ca. 5 mm. longis angulatis supra anguste canaliculatis, laminis 15–20 cm. longis 4.3–6.3 cm. latis subtus argenteo-lucidis medio nervio prominente nervis lateralibus secondariis subprominentibus 7–12 paribus supra planis lepidotis glabris glaucescentibus; pedunculis ca. 10 cm. longis terminalibus vel subterminalibus in axilles foliorum aureo-brunneis squamis pilisque minutis stellatis, pedicellis ca. 6, ca. 2 cm. longis umbellatis; floribus albis gracilibus, calycibus patelliformibus extus argenteo-stellato-pubescentibus 4-lobatis lobis triangularibus 1 mm. longis, tubo 1 mm. alto; petalis oblongis ca. 8 mm. longis 3.5 mm. latis extus minutissime stellato-pubescentibus intus subglabris; staminibus ca. 20, filamentis glabris ca. 2 cm. longis, antheris

oblongis ca. 2 mm. longis, gynophorio glabro ca. 2.5 cm. longo; ovario pluriovulato oblongo 3 mm. longo stellato-pubescenti, stigmate sessili obtuso placentis 3 quisque cum 2 ordinibus ovularum; fructu ignoto.—BOCAS DEL TORO: Fish Creek Mts., Apr. 16, 1941, *H. von Wedel 2235* (Herb. Missouri Bot. Gard., TYPE).

Apparently this species is distinct from any published species known from Panama, Costa Rica, or Colombia. Its affinities are probably with *C. detonsa* Tr. & Pl., judging from the description of that species. In Dugand's clarifying synopsis of *Capparis* in Colombia (Caldasia **2**: 37. 1941), the von Wedel plant keys out to *C. detonsa*, but differs from it especially in having smaller flowers and a less pronounced pubescence. *C. clara* can be distinguished from most or all other species by the very long apical attenuation of the leaf. Characters also distinctive are the silvery sheen of the lower leaf surface, the slender, graceful inflorescence, and the minute golden-brown peltate scales of the very young branches. The leaves are perfectly elliptic, acute at the base, short-petiolate. The flowers are of medium size, 4-parted, umbelliform from an elongate peduncle. The elongate gynophore bears terminally an ovary with 3 placentae, each placenta with 2 rows of ovules. About 20 stamens surround the gynophore.

LEGUMINOSAE

COJOBA CATENATA (D. Sm.) Britton & Rose.—BOCAS DEL TORO: Isla Colón, July 29, 1940, *H. von Wedel 199*. Previously known from Costa Rica.

DITREMEXA LIGUSTRINA (L.) B. & R.—BOCAS DEL TORO: Isla Colón, Aug. 23, 1940, *H. von Wedel 517*. Apparently new to the continent; previously known from the West Indies.

INGA PREUSII Harms—BOCAS DEL TORO: Water Valley, Sept. 9, 1940, *H. von Wedel 672*. Previously known from northern Central America.

MELIACEAE

GUAREA CHICHON C. DC.—BOCAS DEL TORO: Cocoa Cay, vicinity of Chiriquí Lagoon, Oct. 26, 1941, *H. von Wedel 2874*. Previously known from Mexico and British Honduras.

MALPIGHIACEAE

HETEROPTERIS PLATYPTERA DC.—BOCAS DEL TORO: Old Bank Island, Feb. 8, 1941, *H. von Wedel 2027*. Previously known from South America.

DICHAPETALACEAE

DICHAPETALUM **axillare** Woodson, sp. nov. Arbuscula ca. 5 m. alta; ramulis novellis dense cinereo-tomentellis tandem glabratis. Folia brevissime petiolata oblongo-oblanceolata apice obtuse acuminata basim versus acute attenuata cum petiolo ca. 0.3 cm. longo 9–15 cm. longa 2.5–5.0 cm. lata firmiter membranacea venis venulisque utrinque cinereo-pilosulis petiolo simile. Inflorescentia aut terminalis aut axillaris numquam petiolo adnata subcapituliformis pauciflora ca. 1–2 cm. longa et lata dense cinereo-tomentella. Flores ca. 0.1 cm. longi pedicellati albi; sepalis ovatis ca. 0.2 cm. longis extus dense cinereo-pilosulis intus glabris; petalis aequilongis anguste ovatis medio bifidis; ovario ovoideo ca. 0.1 cm. longo dense pilosulo.—COCLÉ: hills north of El Valle de Antón, alt. about 1000 m., July 14, 1940, *P. H. Allen 2202* (Herb. Missouri Bot. Gard., TYPE).

Undoubtedly a close relative of *D. Donnell-Smithii* Engl., which has been reported as ranging from western Panama (probably Chiriquí) to British Honduras. This latter species, however, apparently always has more diffuse inflorescences with peduncles strongly adnate to the petiole of a subtending leaf, the leaves broader and less attenuate toward the base, and the indument less shaggy and conspicuously ferruginous.

DICHAPETALUM NEVERMANNIANUM Standl.—BOCAS DEL TORO: Water Valley, Oct. 30, 1940, *H. von Wedel 1424*. Previously known only from the type collection from Costa Rica.

EUPHORBIACEAE

(L. Croizat)

PERA **aperta** Croizat, sp. nov. Arbor 6-metralis; innovationibus plus minusve conferte crustaceo-lepidotis, indumento haud laeto; foliis more generis in sicco atro-discoloribus, supra costa excepta glabris, subtus lepidibus argillaceis dissitis adspersis, oblongis, apice breviter acuminatis, basi rotundato-cuneatis, 1.0–5 cm. longis, 2–4 cm. latis, margine revoluto subintegro, venis primariis plus minusve patentibus ca. 7-jugis, sat obscuris; petiolo eglanduloso, 1.5–2 cm. longo; inflorescentiis axillaribus, ♀ tantum visis; pedunculo communi gracili, lepidoto, ad 1 cm. longo, apice bracteolis binis ca. 2 mm. longis terminato, floribus ♀ pernudis, scilicet in sacco e bracteolis more generis efformato haud inclusis, glomerulatim 2–5, ecalyculatis vel subecalyculatis, ovario lageniformi, ca. 2.5 mm. longo, stylo in stigmatibus 3 latis, papillosis, obtriangularibus evadente;

loculis in ovario (videtur) 4, semine valde immaturo carunculato.—COCLÉ: hills south of El Valle de Antón, May, 1941, *P. H. Allen 2506*, (U. S. National Herb. TYPE).

The peculiar characters of the new species here described under Mutis's genus *Pera* suggest brief considerations of a preliminary nature on the limits of the genus.

The region in which the type material was collected is aptly characterized in a letter of P. H. Allen to C. V. Morton, quoted in the latter's work on the Gesneriaceae from Panama, and this writer readily agrees with Allen's comment: "I think I can guarantee that you will get some interesting plants" (Ann. Mo. Bot. Gard. **29**: 35. 1942). *Pera aperta,* indeed, is an extremely interesting plant, the first of its kind ever seen by this writer.

Aside from the technicalities of its flowers, *Pera* is supposed to be characterized by a peculiar involucre which surrounds the inflorescence. This involucre (see Pax & Hoffmann in Engler & Prantl's Nat. Pflanzenfam. **19c**: 154, *fig. 78 b,c,d,e.* 1931) is a bracteolate, baglike structure which, towards anthesis, breaks open to expose the ♂ and ♀ flowers. The perianths proper are much reduced, and the entire arrangement may be defined as a coarctate lateral spicate or subglomerulate inflorescence, uni- or bisexual, surrounded by a bract or fused bracts which become open at the time of flowering. On account of the bracteate inflorescence, *Pera* has been maintained by Pax & Hoffmann as the type of the tribe Pereae, placed next to the Dalechampieae in the classification of Engler & Prantl, a disposition which is probably more artificial than natural but is not to be challenged here.

Pera is the subject of an unusually large literature which deals with its sectional or presumedly sectional units. In one of the early studies of this group, Klotzsch (in Wiegm. Arch. **7**: 176. 1841) published the tribe Prosopidoclineae, typified by *Pera* and characterized by: "Ovarii loculi uniovulati. Semina arillata, exalbuminosa. Involucra subgloboso-vesicaeformia, hinc hiantia, deinde plus minusve explanata, demum decidua, 3,4–6 flora, bracteis suffulta. Flores dioeci, apetali." Regarding Klotzsch's later publication of the Peraceae as a family, this writer may remark that Prosopidoclineae is an illegitimate tribal name, because it is not derived from the name of a genus under the group (Art. 24, Internat. Rules Bot. Nomencl., 1935). Non-existent as a taxonomic name under the Rules (Art. 7) are Baillon's "Péridées" (Étude Gén. Euphorb., 433. 1858), improperly cited by Pax & Hoffmann (in op. cit., 153) as

Perideae. The legitimate tribal[1] name for the *Pera* plexus, consequently, remains Mueller's Pereae (Linnaea **34**: 144. 1865).

Klotzsch recognized under the Prosopidoclineae: *Schismatopera* Kl., *Spixia* Leandro do Sacr., *Pera* Mutis, and *Peridium* Schott. This arrangement was criticized by Baillon (op. cit., 268-272), who maintained as a genus only *Pera* with two sections (op. cit., 433-434), Eupera and Schismatopera, characterized, respectively, by "Étamines au nombre de 2–6 (ou plus), unies inférieurement dans une étendue peu considérable," and "Étamines 4–8 monadelphes; filets soudés en une colonne cylindrique plus longue." This separation rests upon an essential difference apparent in many euphorbiaceous flowers, some of which have the androecium connate to form a staminal column *(Jatropha,* for instance); others, on the contrary, have solute stamens *(Manihot* being an example). Whether this difference holds good in *Pera,* as claimed by Baillon, this writer does not know; its basis is sound in theory, but it may be found in practice that the much reduced perianths of *Pera* bear both androecia set up into columns or more or less solute, within the same natural affinity.

In his elaboration of the Euphorbiaceae (in DC. Prodr. **15**[2]: 1025-1031. 1866), Mueller maintains five sections, Schismatopera (Kl.) Baill., Eupera Baill., Spixia (Leandro do Sacr.) Baill., Neopera Griseb., Peridium (Schott) Muell.-Arg. Another section, Diplopera, is added by Mueller in Martius, 'Flora Brasiliensis' (**11**[2]: 423. 1874), which Mueller describes as follows: "Involucra basi unibracteolata, bisexualia, simul flores masculos 3–4 centrales et femineos periphericos gerentia. Calyx masc. evolutus . . . Sectio insigniter peculiaris. . . ." Six sections, too, are maintained in the most recent classification of Pax & Hoffmann (op. cit., 154), as follows: Diplopera Muell.-Arg., Perula (Schreb.) Pax & Hoffmann, Spixia (Lean-

[1] The proper definition and correct consequent use in modern taxonomy of the units between the genus and the family, and the genus and the species, published by early or comparatively early authors, is beset with difficulties on account of the loose and conflicting manner in which these authors were wont to interpret or define these units. For instance: Mueller published the Pereae, but designated and consequently used them as a subtribe, not as a tribe. Since Art. 24 of the current Rules declares that the name of a tribe ends in -eae and that of a subtribe in -inae, there is conflict between Mueller's name and his own designation of it. This writer believes that, *in principle,* such conflicts are to be defined in the sense that the designation of the rank by the author of the name is irrelevant, under Art. 24, so long as it is contradicted by the name's ending. Thus, the Pereae of Mueller, having the legitimate ending of a tribal name, are to be accepted in modern taxonomy *as a tribe,* despite Mueller's insistence that *they are a subtribe.* This principle is general and important enough to deserve special mention here.

dro do Sacr.) Muell.-Arg., Schismatopera (Kl.) Baill., Neopera Griseb., Peridium (Schott) Muell.-Arg. This classification, which does not differ from that of Mueller in essential characters, is erroneous in two respects: (1) It substitutes Perula Pax & Hoffm. for Eupera Baill., under the evidently mistaken assumption that Schreber's Perula, being earlier than Eupera Baill., must be used as the basis for a new combination. Pax & Hoffmann probably are not aware of the fact that new combinations are required (Art. 53) only when names are transferred *without a change of rank*, it being illegitimate to effect a transfer, *when the rank is changed* and the position is preoccupied (Art. 16, Art. 61 [1]).[1] (2) It mistakenly credits the combination of Spixia to Mueller, while this combination was effected by Baillon (in Adansonia **5**: 222. 1864-1865).

Under the systematic viewpoint, none of the current subgeneric units of *Pera* even approach the characters of *P. aperta*, for in this peculiar plant the involucre is absent, or at least reduced to minute bracteoles at the base of the gynoecium. In view of the emphasis placed throughout classification upon the involucre as a generic character it should be possible to elect *P. aperta* as the type of a new genus. This writer does not believe that the erection of a new genus is advisable, at least until much better material is available, because: (1) The Euphorbiaceae are identified by a tendency towards reduction and recombination of the floral organs rather than by set morphological characters. Accordingly, tendencies count in their classification far more than do characters; (2) The wood characters of *P. aperta* are those of Mutis's genus, as this writer has kindly been informed by Prof. I. W. Bailey of the Biological Laboratories of Harvard University, and so its gross morphology is that of *Pera*. (3) It is not to be overlooked that certain species in the vicinity of *P. aperta* may have partially developed involucres, intermediate between those of this species and the ones of *P. arborea* and its immediate allies. In conclusion, the emphasis placed upon the involucre as a generic character of *Pera* is not completely justified, and rather than a new genus, an emended description of *Pera*, the Pereae, and two new subgenera are required, as follows:

PERA Mutis in Svensk. Vetensk. Akad. Handl. Stockholm **5**: 299. 1784; Muell.-Arg. in DC. Prodr. **15**[2]: 1025. 1866, et in Mart. Fl. Bras.

[1] On account of a faulty interpretation of Art. 58, some botanists believe that older names must be maintained even when the rank is changed. This fallacy is refuted in a paper on the trinomial *typicus*, by this writer, now in course of publication.

11²: 421. 1874; Pax & Hoffmann in Engler & Prantl's Nat. Pflanzenfam. **19c**: 153. 1931; *Croiz. descr. emend.*

Flores utriusque sexus in involucro alabastriformi inclusi (subg. Eupera), involucro saltem ♀ interdum (subg. Gymnopera) nullo vel subnullo.

This emendation modifies also the characters of the Tribe Pereae, which is essentially based upon *Pera*, as follows:

Pereae Muell.-Arg. in Linnaea **34**: 144. 1865, et in DC. Prodr. 15²: 1025. 1866; Pax & Hoffmann in Engler & Prantl's Nat. Pflanzenfam. **19c**: 153. 1931; *Croiz. descr. emend.*

Flores utriusque sexus saepissime in involucro alabastriformi inclusi.

Pera subg. **Eupera** (Baill.) Croiz., st. nov. *(Pera* Sect. *Eupera* Baill. in Étude Gén. Euphorb., 434. 1858, p.p.typ.; *Pera* Sect. *Perula* [*nomen serius illegitimum*] Pax & Hoffm. in Engler & Prantl's Nat. Pflanzenfam. **19c**: 154. 1931).

Floribus utriusque sexus in involucris alabastriformibus inclusis.

Typus nomenclaturalis: *Pera arborea* Mutis.

This writer does not know whether all the sections of Mueller and Pax & Hoffmann properly belong to a single subgenus, although he accepts as most probable at this writing that a separation can be established between *Pera* ssp. in general and *P. aperta* on the strength of the involucre character. In Martius', 'Flora Brasiliensis' (op. cit., 11²: 421. 1874) Mueller accepts *Pera* "sensu Baill.," a disposition which this writer is neither prepared to challenge nor to endorse without qualification at this time.

Pera subg. **Gymnopera** Croizat.

Floribus saltem ♀ involucro alabastriformi carentibus, ad bracteolas minimas reducto.

Typus nomenclaturalis: *Pera aperta* Croizat.

HIPPOCRATEACEAE

Hippocratea celastroides HBK.—bocas del toro: Old Bank Island, Feb. 8, 1941, *H. von Wedel 2038*. Known from northern Central America and recorded from Colombia. Specific delimitation in this genus is at present so uncertain that it cannot be stated with surety that the von Wedel specimen is correctly determined. However, it matches other specimens so labeled in the herbarium, and seems distinct from *H. volubilis* L. growing in the same locality.

Hippocratea ovata Lam.—bocas del toro: vicinity of Chiriquí Lagoon, Oct. 7, 1940, *H. von Wedel 1059*. Known from South

America. This Wedel specimen in fruit may prove to be the same as *H. volubilis* or *H. celastroides,* but best matches specimens in the Missouri Botanical Garden herbarium labeled *H. ovata.*

ICACINACEAE

(R. A. Howard)

DISCOPHORA MONTANA Howard—BOCAS DEL TORO: Fish Creek Mts., Apr. 14, 1941, *H. von Wedel 2225.* Previously known only from Colombia.

SAPINDACEAE

CUPANIA HIRSUTA Radlk.—PANAMÁ: Vicinity of Capira, Feb. 12, 1939, *P. H. Allen 1687.* Previously known from South America. No satisfactory separation seems possible between this species and specimens in the herbarium labeled *C. fulvida.* The Allen specimen is intermediate between South American forms represented in the herbarium as *C. hirsuta,* and Costa Rican forms represented by specimens determined as *C. fulvida* Tr. & Pl.

PAULLINIA CALOPTERA Radlk.—BOCAS DEL TORO: Water Valley, Sept. 23, 1940, *H. von Wedel 904.* Previously known from South America.

QUIINACEAE

(P. C. Standley)

LACUNARIA **panamensis** (Standl.) Standl., comb nov. (*Quiina panamensis* Standl. Field Mus. Publ. Bot. **4**: 236. 1929).—COCLÉ: hills north of El Valle de Antón, trail to La Mesa, alt. about 1000 m., Aug. 31, 1941, *P. H. Allen 2689.* A tree 15 m. tall; fruits woody, brown. *Quiina panamensis* was based upon *G. Proctor Cooper 609,* from Buena Vista Camp on Chiriquí trail, Prov. Bocas del Toro, and consisted of specimens in bud. Study of the type and of the recent collection obtained by Mr. Allen shows that the tree belongs to the genus *Lacunaria,* segregated in 1925 from *Quiina* by Dr. Ducke. Rather numerous *Quiina* species of South America have been transferred to *Lacunaria* in recent years, and it is not surprising to find a member of the genus in Panama. The only other member of the family known from North America, *Quiina Schippii* Standl. of British Honduras, is properly referable to *Quiina.*

Mr. Allen's material includes a mature fruit, which may be described as follows: Fruit depressed-globose, in shape resembling that of *Hura crepitans,* about 8 cm. broad and 5.5 cm. high, slightly depressed at the apex, densely costate vertically with low rounded

ribs, filled with pulp, the pericarp hard and woody, 3 mm. thick; seeds about 1 cm. long, very densely covered with long brown hairs.

TILIACEAE

(P. C. Standley)

MORTONIODENDRON **hirsutum** Standl., sp. nov.—Frutex metralis, ramis gracilibus ochraceis teretibus, novellis pallide viridibus sat dense pilis longis patentibus fulvis hirsutis; folia breviter petiolata membranacea, petiolo crassiusculo 4–5 mm. longo hirsuto; lamina anguste oblonga vel lanceolato-oblonga 10.5–17 cm. longa 3–4.5 cm. lata, apice longissime lineari-attenuata, basi insigniter obliqua, latere interiore acuta, exteriore late rotundata vel subcordata, supra in sicco viridis ad costam sparse hirsuta, aliter glabra, venis prominulis laxe reticulatis, subtus fere concolor ad costam nervosque hirsuta, costa tenui elevata, nervis lateralibus utroque latere 8–9 tenerrimis arcuatis, venis prominulis laxe reticulatis, basi trinervia; inflorescentia (tantum in statu fructifero visa) terminalis longipedunculata ut videtur pauciflora, rhachi hirsuta, pedicellis fructiferis ca. 12 mm. longis crassiusculis; capsula depresso-globosa lutea ca. 2 cm. alta atque 2.5 cm. lata valde rugosa, valvis crassis ca. 12 mm. latis; semina in quoque loculo 2 crassa obtuse angulata 6 mm. diam. —BOCAS DEL TORO: Water Valley, vicinity of Chiriquí Lagoon, Nov. 21, 1940, *H. von Wedel 1694* (Herb. Missouri Bot. Gard. TYPE).

The genus *Mortoniodendron* Standl. & Steyerm., published in 1938 and based upon a Panama plant, has grown surprisingly in species numbers during the past few years. In 1940 two species were described from Honduras and Guatemala, the present being the fourth known representative of the genus. *M. hirsutum* may be recognized at once as distinct from the other Panama species, *M. anisophyllum* (Standl.) Standl. & Steyerm., by its fairly abundant pubescence of long, stiff, straight spreading hairs, a character which distinguishes it also from the more northern species.

BOMBACACEAE

CEIBA **Allenii** Woodson, sp. nov. Arbor epiphytica ramosissima ut dicitur ca. 10–12 m. alta; ramulis crassiusculis rimosis sparse aculeolatis. Folia desunt. Flores solitarii vel bini magni speciosi; pedicellis crassiusculis ca. 2 cm. longis; calyce late urceolato ca. 2 cm. longo ostio ca. 1.5 cm. diam. obscure irregulariterque 2- vel 5-lobato coriaceo glabro vel indistincte papillato; petalis 5 oblongis rotundatis minute emarginatis 5–6 cm. longis ca. 1.5 cm. latis carnosis

patulis extus papillatis marginibus densius saturate roseis intus lacteis; staminibus 5, filamentis 3.5–4.0 cm. longis ca. ½ longitudine connatis, antheris linearibus dorsifixis ca. 3.5 cm. longis basi bifidis. —COCLÉ: hills north of El Valle de Antón, alt. about 1000 m., May 10, 1942, *P. H. Allen 2924* (Herb. Missouri Bot. Gard. TYPE).

Ceiba Allenii falls readily into Schumann's section Eriodendron, previously represented by two species of central Brazil. From our species *C. Rivieri* (Dcne.) K. Sch. differs because of its shorter, truncate calyx, and *C. Erianthos* K. Sch. because of its more slender habit and much smaller flowers. It is very unfortunate that the plant bloomed in a leafless condition. Mr. Allen describes it as a "strangler tree" similar to species of *Ficus*.

STERCULIACEAE

THEOBROMA **asclepiadiflorum** Schery n. sp. Arbor ut dicitur 30 m. alta; ramis glabris brunneis; foliis magnis 30–40 cm. longis 10–13 cm. latis ellipticis utrinque omnino glabris apice cuspidatis basi acutis in petiolis subdecurrentibus subtus costa 1 prominentissima nervis lateralibus 24–34 arcuatis prominentibus; petiolis ca. 1.5 cm. longis supra subcanaliculatis; inflorescentiis cymiformibus, pedunculis brunneis stellato-tomentosis 3–4-pli-divisis in multos pedicellos cum bracteis parvis ad locos divisionum; floribus coccineis magnis; sepalis anguste ovato-lanceolatis ca. 12 mm. longis 3–4 mm. latis crassis reflexis extus stellato-tomentosis intus glabris margine puberulentis basi pilis crassis glandulosis luteis; petalis obovatis cochleatis 6 mm. longis 4 mm. latis interne glabris externe apice pubescentibus cum ligulis rotundatis lepidotis; staminibus et staminodiis basi cohaerentibus in tubum glabrum 2 mm. altum, filamentis glabris 3 mm. longis cum 2 antheris bilocularibus, staminodiis anguste lanceolatis 10 mm. longis basi 2 mm. latis puberulentis; ovario ellipsoideo tomentoso 5-lobato cum stylo 5-partito; fructibus ignotis.—BOCAS DEL TORO: Water Valley, Nov. 8, 1940, *H. von Wedel 1535* (Herb. Missouri Bot. Gard. TYPE).

Although fruiting material of this species is lacking, floral and vegetative characters distinguish it sufficiently to warrant description as a new species. As in *T. Cacao* the branchlets and leaves are entirely glabrous, a character which separates it from the typical *T. bicolor*. The elliptic leaves are not asymmetric at the base and are subdecurrent on the petiole. The inflorescence is a many-flowered cyme about 5 cm. long, branching 3 or 4 times in a di- or trichotomous fashion. The large red flowers, with their reflexed sepals,

cochleate petals resembling hoods and long narrow staminodes resembling horns, superficially simulate asclepiadaceous flowers. The ligules of the petals are more or less sessile, not clawed as in *T. Cacao*. The long thin staminodes appear tentacular, not foliaceous as in *T. simiarum*. The form of the ovary suggests that the fruit is shallowly 5-lobed.

DILLENIACEAE

(C. V. Morton)

SAURAUJA PAUCISERRATA Hemsl.—COCLÉ: trail to Las Minas, north of El Valle de Antón, alt. 1000 m., May 10, 1941, *Paul H. Allen 2464*. This species was described from the Volcán de Fuego, Guatemala. The present specimen agrees with the description and with a photograph of the type. Several specimens from Guatemala and El Salvador have been referred to this species, some of which may be incorrectly identified. The recently described *S. Seibertii* Standl., which also has glabrous leaves, differs (from description) in its larger sepals and petals, longer inflorescence and pedicels, and larger, many-veined, more strongly serrate leaves.

OCHNACEAE

SAUVAGESIA ELATA Benth.—BOCAS DEL TORO: Old Bank Island, Feb. 8, 1941, *H. von Wedel 2029*. Previously known from South America.

MARCGRAVIACEAE

MARCGRAVIA NEPENTHOIDES Seem.—BOCAS DEL TORO: Water Valley, Sept. 17, 1940, *H. von Wedel 818;* Chiriquí Lagoon, Oct. 15, 1940, *H. von Wedel 1192*. Previously known from northern Central America, possibly reported from Costa Rica. The von Wedel specimens check well with published illustrations of this species, although differing somewhat from the only specimen in the herbarium under this name.

NORANTEA ALBIDO-ROSEA Gilg, ex char.—BOCAS DEL TORO: Old Bank Island, Feb. 8, 1941, *H. von Wedel 2035*. Known from Costa Rica. This specimen may well prove to be the same as *N. Brenesii* Standl., also known from Costa Rica, corresponding within the limits of variability with specimens of the latter in the herbarium. However the original description of *N. Brenesii* does not fit the von Wedel specimen as accurately as that of *N. albido-rosea*. The plant can be distinguished from *N. subsessilis* (Benth.) D.Sm. by its subumbelliform inflorescence.

GUTTIFERAE

Clusia **longipetiolata** Schery, n.sp. Arbuscula circ. 30 m. alta; ramis glabris irregulariter nodulatis internodiis 0.5–1.5 cm. longis; foliis magnis longe-petiolatis glabris crassis coriaceis; laminis ellipticis vel obovato-oblongis basi cuneatis apice rotundatis margine leviter subrevolutis, nervis lateralibus multis (60-90) circ. 80° a nervo medio divergentibus utrinque prominentibus; petiolis 4.5–8.0 cm. longis crassis in sicco longitudinaliter striatis subteretibus vel angulatis sed non alatis basi lacunis semicrateriformibus; inflorescentiis terminalibus cymiformibus 2–3-floris; pedicellis principalibus 0.5–1.0 cm. longis apice cum bracteis 2 deltoideis oppositis; pedicellis secondariis subteretibus crassis 1–2 cm. longis item apice cum 2 bracteis deltoideis oppositis; floribus flavo-albis magnis circ. 5–6 cm. latis; 2 lobis calycis exterioribus basi concretis patelliformibus fulgidis, 5 aliis lobis late ovato-rotundatis coriaceis; petalis submembranaceis ovato-rotundatis, circ. 2.5 cm. longis, 3 cm. latis; toro cylindrico 6–7 mm. alto ovarium circumdante; ovario 5-carpellato pyramidali stigmati sessili; flores masculae ignotae.—BOCAS DEL TORO: vicinity of Chiriquí Lagoon, alt. near sea-level, Oct. 12, 1940, *H. von Wedel 1136* (Herb. Missouri Bot. Gard. TYPE).

This species is distinguishable especially by its large cream-colored flowers, very long unwinged petioles, and thick coriaceous leaves. The torus (fused staminodia of Vesque) is cylindric-campanulate, completely surrounding the 5-carpellate ovary to a height of 6 or 7 mm. The relationship of this species is probably with *C. rosea, C. Cooperi, C. stenophylla,* etc., from the same general region. Although belonging to a genus in which "probable new species" of distinctive appearance are continually turning up, this von Wedel specimen could not be satisfactorily matched in the herbarium, nor in Vesque's monograph nor with recent descriptions.

VIOLACEAE

(C. V. Morton)

Ionidium Thiemei Donn. Smith—COCLÉ: north rim of El Valle de Antón, June 4, 1939, *Alston & Allen 1859.* This collection was distributed as *Hybanthus parietariifolius* (DC.) Loes., a synonym of the annual species, *H. attenuatus* (H. & B.) G. K. Schulze. *Ionidium Thiemei* (previously known from Mexico to Honduras) is a perennial, and differs in many ways from *H. attenuatus.* It is to be referred to the genus *Hybanthus* also, of course, but I refrain from

making a combination at the present time, inasmuch as I am preparing a paper to be published elsewhere on the North American species of this genus.

FLACOURTIACEAE

LUNANIA PITTIERI Standl.—BOCAS DEL TORO: Fish Creek, mountains, May 7, 1941, *H. von Wedel 2396*. Previously known only from the type collection from Costa Rica.

TURNERACEAE

(C. V. Morton)

ERBLICHIA ODORATA Seem.—COCLÉ: trail to Las Minas, north of El Valle de Antón, alt. 1000 m., May 10, 1941, *Paul H. Allen 2468*. This genus was long considered monotypic, but in a recent revision Standley and Steyermark (Field Mus. Publ. Bot. **22**: 351–357. 1940) have recognized three species and one variety. According to their treatment, the present specimen woud key at once to *E. Standleyi* Steyerm. of Oaxaca and Honduras. However, both Standley and Steyermark have studied Allen's specimen and are inclined to place it with *E. odorata*, the type species of the genus, which was originally collected in Panama but has not since been found there, although it is rather common in Costa Rica. Allen's collection throws some doubt on the validity of *E. Standleyi* as a species, since it differs from typical *E. odorata* in the same characters (glabrous ovary and branchlets) as *E. Standleyi* does from *E. xylocarpa*.

CARICACEAE

CARICA DOLICHAULA D. Sm.—BOCAS DEL TORO: Chiriquí Lagoon, Oct. 8, 1940, *H. von Wedel 1084*. Previously known from Costa Rica and ranging to British Honduras.

CACTACEAE

(L. Cutak)

EPIPHYLLUM MACROPTERUM (Lemaire) Britton & Rose—BOCAS DEL TORO: Water Valley, Sept. 12, 1940, *H. von Wedel 736;* vicinity of Chiriquí Lagoon, Oct. 16, 1940, *H. von Wedel 1164*. Previously known from Costa Rica.

EPIPHYLLUM PITTIERI (Weber) Britton & Rose—BOCAS DEL TORO: vicinity of Chiriquí Lagoon, Oct. 21, 1940, *H. von Wedel 1294*. Previously known from Costa Rica.

THYMELIACEAE

SCHOENOBIBLUS PANAMENSIS Standl.—BOCAS DEL TOTO: Isla Colón, *H. von Wedel 410*, Aug. 12, 1940. This is apparently the first record of the genus for North America. Species have previously been known from South America and the West Indies.

ONAGRACEAE

JUSSIAEA LATIFOLIA Benth.—BOCAS DEL TORO: Water Valley, *H. von Wedel 781*, Sept. 14, 1940; Chiriquí Lagoon, *H. von Wedel 1384*, Oct. 18, 1940. Previously known from South America.

LOGANIACEAE

POTALIA AMARA Aubl.—BOCAS DEL TORO: Fish Creek Mts., Apr. 30, 1941, *H. von Wedel 2369*. Previously reported from Costa Rica and South America. Although to be expected from Panama, this collection is of interest in that it apparently is only the third or fourth for the genus from North America. The ovary of the von Wedel plant is four-carpellate in contrast to the two-celled condition reported by Standley (Fl. Costa Rica, p. 921. 1938) and the three-celled condition reported by Aublet (Pl. Gui. **1**: 394. *pl. 151.* 1775) in the original description for the species.

APOCYNACEAE

STEMMADENIA **lagunae** Woodson, sp. nov. Arbor vel arbuscula ca. 5–12 m. alta omnino glabra; ramulis dichotomis gracillimis, internodiis ca. 1.0–2.5 cm. longis. Folia opposita inaequalia breviuscule petiolata elliptica apice abrupte subcaudato-acuminata basi in petiolum attenuata 4.5–14.0 cm. longa 1.5–5.0 cm. lata; petiolis 0.3–0.8 cm. longis. Inflorescentiae terminales vel subterminales bostrycino-racemosae pauci- vel pluriflorae; pedunculo simplici vel basi dichotomo 1.0–2.5 cm. longo omnino minute bracteato cicatricosoque; pedicellis ca. 0.5 cm. longis. Calycis laciniae oblongae vel oblongo-oblanceolatae acutae vel obtusae valde inaequalia 1–2 cm. longae subfoliaceae. Corolla pallide aurea infundibuliformis tubo proprio 2.5–3.0 cm. longo basi ca. 0.2–0.3 cm. diam. superne contorto angustioreque ibique staminigero faucibus conicis abrupte dilatatis 1.0–1.25 cm. longis ostio ca. 0.5–0.7 cm. diam. lobis oblique obovatis acuminatis 1.5–2.0 cm. longis patulis. Folliculi ignoti.—BOCAS DEL TORO: Careening Cay, July-Aug., 1940, *H. von Wedel 570* (Herb. Missouri Bot. Gard., TYPE); Water Valley, Sept. 6, 1940, *H. von Wedel 587* (Herb. Missouri Bot. Gard., COTYPE).

This species of the *S. Alfari* complex is interesting because of its occurrence near the coast of the Chiriquí Lagoon, the other species inhabiting higher altitudes. It apparently is most closely allied to *S. Allenii* Woods., which has much shorter calyx lobes (0.6–0.9 cm.) and corollas of different proportions and size (proper tube 1.0–1.25 cm. long; throat about 2 cm. long).

Prestonia **Wedelii** Woodson, sp. nov. Frutex volubilis; ramulis dense ferrugineo-tomentosis. Folia brevissime petiolata ovato-elliptica apice acuminata basi obscure cordata 13–16 cm. longa 6–10 cm. lata utrinque subtus densius minute ferrugineo-tomentella, petiolo 0.2–0.5 cm. longo tomentoso. Inflorescentia dense bostrycino-racemosa multiflora; pedunculo 2–15 cm. longo ferrugineo-tomentoso, pedicellis 0.5–0.7 cm. longis similiter vestitis; bracteis anguste lanceolatis ca. 1 cm. longis foliaceis pilosis. Calycis laciniae oblongo-lanceolatae longe acuminatae 3.0–3.5 cm. longae foliaceae pilosae; squamellis deltoideis apice emarginatis vel laceratis sparse pilosulis. Corolla luteo-lactea extus dense ferrugineo-tomentella tubo infundibuliformi ca. 4 cm. longo basi ca. 0.2 cm. diametro tertia parte superiore staminigera ibique conico-dilatata ostio ca. 0.7–0.8 cm. diametro, lobis oblique ovatis acuminatis ca. 1.2 cm. longis patulis; annulo faucali bene manifesto ca. 0.1 cm. lato continuo haud lobato. Ovarium glabrum ca. 0.2 cm. altum; nectario conico-annulato ostio 5-lobato glabro ovarium paulo superante.—BOCAS DEL TORO: Water Valley, vicinity of Chiriquí Lagoon, Oct. 26, 1940, *H. von Wedel 1353* (Herb. Missouri Bot. Gard., TYPE).

Superficially similar to *P. Allenii,* but with shorter pubescence and obscurely cordate leaves. The flowers of *P. Allenii,* also, are larger, and the faucal annulus of the corolla consists of 5 discrete, round lobes.

Bonafousia Sananho (R. & P.) Mgf.—COCLÉ: vicinity of La Mesa, region of El Valle de Antón, alt. ca. 1000 m., Nov. 12, 1941, *P. H. Allen 2804.* Previously known from western Colombia (Bogotá), eastern Ecuador, eastern Peru, and western Brazil. This discovery is of particular interest since it represents an element of *Tabernaemontana* previously thought to be entirely South American. Other South American species have been collected by Mr. Allen in the region of El Valle, and this element probably is considerable in its flora.

ASCLEPIADACEAE

Sarcostemma odorata Hemsl.—BOCAS DEL TORO: Water Valley, Nov. 23, 1940, *H. von Wedel 1755.* Previously collected in Guatemala

and Costa Rica. Our plants differ somewhat from those of Guatemala in being practically glabrous.

GONOLOBUS **Ophioglossa** Woodson, sp. nov. Frutex volubilis; ramulis gracilibus laxe pilosulis. Folia opposita longiuscule petiolata heterophylla oblongo- vel obovato-ovalia apice acuminata basi aut obtusa aut obscure sagittata aut profunde cordato-sagittata 4–10 cm. longa 1.5–4.5 cm. lata membranacea glabra; petiolo 1–2 cm. longo minute pilosulo. Inflorescentia extra-axillaris subumbellata pluriflora; pedunculo 0.3–0.7 cm. longo glabro; pedicellis tenuibus ca. 2 cm. longis glabris; bracteis minimis. Flores virides; calycis laciniis ovato-lanceolatis acuminatis ca. 0.3 cm. longis glabris; corolla rotata ca. 3 cm. diam. omnino glabra, lobis late ellipticis ca. 1.5 cm. longis margine albo; corona acute 5-gona plana laevi corollae annulum carnosum minute puberulo-papillatum aequante; gynostegio stipitato acute 5-gono ca. 0.35 cm. diam., antherae appendicibus dorsalibus anguste ligularibus ca. 0.2 cm. longis apice furcatis patulis.—COCLÉ: vicinity of La Mesa, north of El Valle de Antón, alt. about 1000 m., April 12, 1941, *P. H. Allen 2366* (Herb. Missouri Bot. Gard., TYPE).

This species of the subgenus Eugonolobus is outstanding not only because of the ligular, forked anther appendages which suggest its name, but also because of the variable leaves.

BORAGINACEAE

BOURRERIA SUPERBA Johnston var. **glabra** Schery, var. nov. Ab specie differt foliis utrinque glabris et calycibus glabris loborum marginibus intus tomentosis exceptis.—BOCAS DEL TORO: Isla Colón, June 3, 1941, *H. von Wedel 2472*. This variety resembles the species except that the lower leaf surface and the inside of the calyx tube are entirely glabrous. The margins of the calyx lobes, however, are white-tomentose on the inside. The large size of the flowers (about 4 cm. long, 4 cm. wide) distinguishes this species from other species previously known from the region. *B. superba* is known from Mexico (Michoacan).

SOLANACEAE

CAPSICUM STANDLEYANUM Morton—BOCAS DEL TORO: vicinity of Chiriquí Lagoon, Oct. 23, 1940, *H. von Wedel 1316*. Previously known from Costa Rica. This species as represented by the von Wedel specimens may not be distinct from *C. stenophyllum* Morton & Standley. The leaves are strongly dimorphic, resembling those of *Solanum diphyllum*.

BIGNONIACEAE

SCHLEGELIA **fastigiata** Schery, sp. nov. Frutex scandenti-epiphyticus; ramulis teretibus brunneis rugosis parvis cum lenticellis prominentibus ovalibus albis; foliis magnis glabris coriaceis ellipticis apice acutis basi rotundatis vel acutis in petiolo decurrentibus, nervis reticulatis supra aliquid impressis inconspicuis subtus prominentibus nervis lateralibus arcuatis ad margines, aliquid confluentibus, 12–25 cm. longis, 4–10 cm. latis; petiolis crassis, supra subcanaliculatis, ca. 1 cm. longis, 3–4 mm. latis; inflorescentiis terminalibus vel subterminalibus crassis condensatis fastigiatis sessilibus, 2–7 cm. longis, 5–10 cm. latis, plurimis subcorymbiformibus racemis compositis; pedicellis 4–8 mm. longis, 0.5–1.0 mm. latis; calycibus plus minusve 4-lobatis vel subtruncatis cylindrico-campanulatis reticulàto-subrugosis glabris, 7–10 mm. longis; corolla glabra, 1.0–2.5 cm. longa, 5-lobata, lobis ca. 2.5 mm. longis, ovato-triangularibus subhastatis imbricatis, tubo plus minusve cylindrico, ca. 8 mm. longo; staminibus 4, ca. 5 mm. longis, ⅓ longitudine tubi adjunctis; staminodio 1; filamentis glabris aequalibus linearibus basi latioribus; antheris bilocularibus, loculis longitudinaliter dehiscentibus basi divergentibus; stylo crasso, ca. 2 mm. longo apice aliquid bifidi; ovario sessili biloculari pluriovulato basi crasso-carnoso; fructibus globularibus purpureis lepidotis, circiter 14 mm. diametro.—BOCAS DEL TORO: Water Valley, Sept. 14, 1940, *H. von Wedel 773* (Herb. Missouri Bot. Gard., TYPE); Isla Colón, July 26, 1940, *H. von Wedel 154* (Herb. Missouri Bot. Gard., COTYPE); Water Valley, Oct. 31, 1940, *H. von Wedel 1447* (Herb. Missouri Bot. Gard., COTYPE).

This species seems to be most closely allied to *S. lawrancei* Standl. and *S. dariensis* Sandw. (ex char.). Like *S. dariensis* it seems to be intermediate between short, lateral inflorescence types (sect. Parantanaecium K. Schum.) and long terminal inflorescence types (sect. Euschlegelia K. Schum.). The species differs from *S. lawrancei* chiefly in having a very characteristic inflorescence and more narrowly elliptic leaves, and from *S. dariensis* (ex char.) especially in having elliptic rather than broadly ovate, more or less cordate leaves.

The most striking and characteristic feature of this species is the dense fastigiate inflorescence which resembles "witches broom." The many pedicels and peduncles are so congested that it would be impossible for each to bear a flower simultaneously. Leaves are elliptic, short-petiolate, acute to rounded at the base and somewhat

decurrent into the petiole, acute apically. The flowers are reported as red (calyx) and white (corolla). The calyx is subtruncate or shallowly 4-lobed, glabrous within and without. The corolla is glabrous, small, 1.0–2.5 cm. long, 5-lobed, the lobes being imbricate, ovate-triangular, subhastate. The tube is about 8 mm. long and bears at about 3 mm. from the base 4 stamens and one staminode. The filaments are glabrous, linear, slightly broader at the base than above. The anthers are bilocular, the locules dehiscing longitudinally and diverging from one another basally. The style is stigmatose and slightly bifid apically. The ovary is 2-celled, many ovules being borne in each cell from a central placenta.

ARRABIDAEA CHICA (H. & B.) Verl.—BOCAS DEL TORO: Water Valley, Sept. 19, 1940, *H. von Wedel 860*. Previously known from British Honduras and Guatemala, possibly other countries.

LENTIBULARIACEAE

(C. V. Morton)

UTRICULARIA ENDRESII Rchb. f.—COCLÉ: hills north of El Valle de Antón, alt. 1000 m., Sept. 1, 1941, *Paul H. Allen 2704*. Previously known only from Costa Rica.

RUBIACEAE

(P. C. Standley)

ISERTIA HYPOLEUCA Benth.—BOCAS DEL TORO: Nances Cay Island, *H. von Wedel 580*, Sept. 2, 1940. Previously known from Colombia and other South American countries.

GUETTARDA CRISPIFLORA Vahl.—BOCAS DEL TORO: Isla Colón, *H. von Wedel 508a*, Aug. 20, 1940. Previously known from Costa Rica and the West Indies.

ALLENANTHUS ERYTHROCARPUS Standl.—This well-marked genus has been known from the single type collection, and still has been collected only in the region of the type. An additional collection of it is worth reporting: COCLÉ: Region of El Valle de Antón, trail to Las Minas, alt. about 700 m., Sept. 1941, *P. H. Allen 2713*. A tree of 8–25 m.; fruits pink to red; trees abundant and conspicuous along the upper reaches of the Río Antón.

RUDGEA SKUTCHII Standl.—COCLÉ: hills north of El Valle de Antón, trail to La Mesa, alt. about 1000 m., Aug., 1941, *P. H. Allen 2699*. A shrub 3 m. tall, the flowers white. Described from the vicinity of El General, Costa Rica, and known heretofore only from the original collection.

CUCURBITACEAE

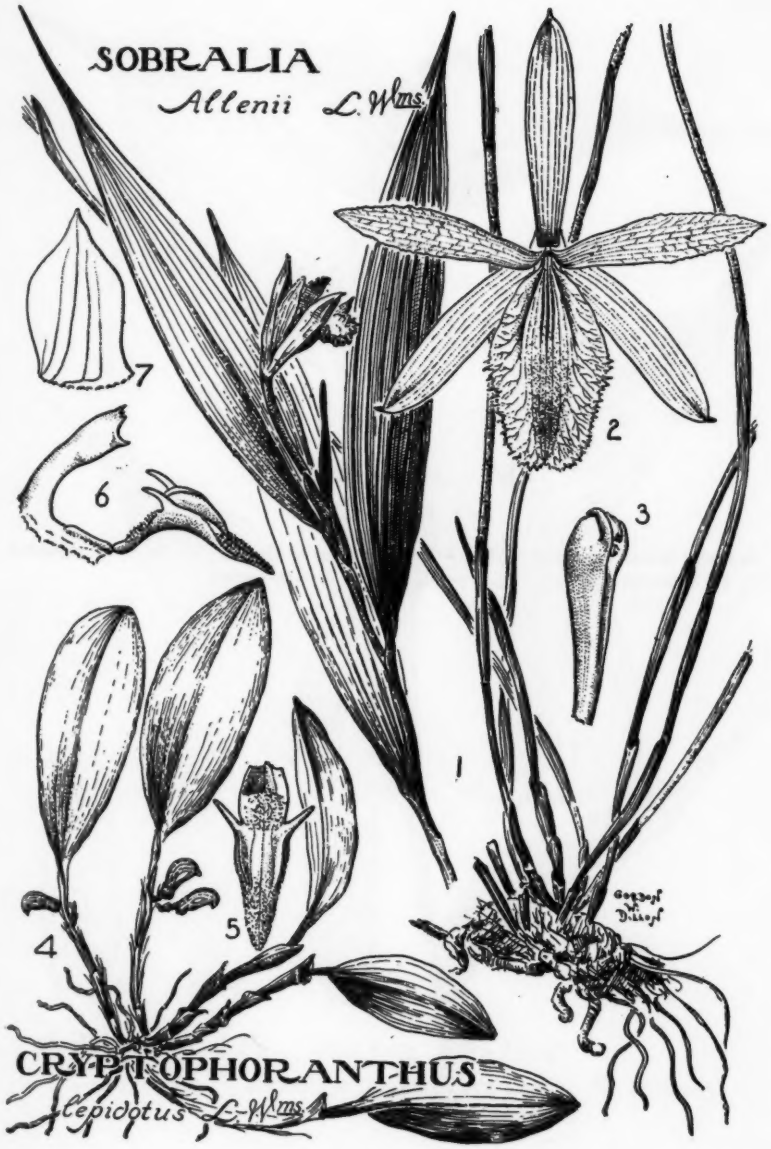
SELYSIA PRUNIFERA (Poepp. & Endl.) Cogn.—BOCAS DEL TORO: Water Valley, Nov. 13, 1940, *H. von Wedel 1596*. Standley reports that this is the first record of this genus north of South America. The species was previously known from Peru.

EXPLANATION OF PLATE

PLATE 30

Figs. 1–3. *Sobralia Allenii* L. Wms.: fig. 1, plant, × ½; fig. 2, flower with segments expanded, × 1; fig. 3, column, × 2.

Figs. 4–7. *Cryptophoranthus lepidotus* L. Wms.: fig. 4, plant, × ½; fig. 5, lip, × 5; fig. 6, lip and column from the side, × 5; fig. 7, petal, × 5.



WOODSON & SCHERY—FLORA OF PANAMA

EXPLANATION OF PLATE

PLATE 31

Sobralia decora var. *aerata* Allen & Williams: fig. 1, plant, × ½; fig. 2, lip expanded, × 1; fig. 3, lateral sepal, × 1; fig. 4, petal, × 1; fig. 5, dorsal sepal, × 1.

SOBRALIA *decora* Batem
var. *aerata* Allen & Williams

WOODSON & SCHERY—FLORA OF PANAMA

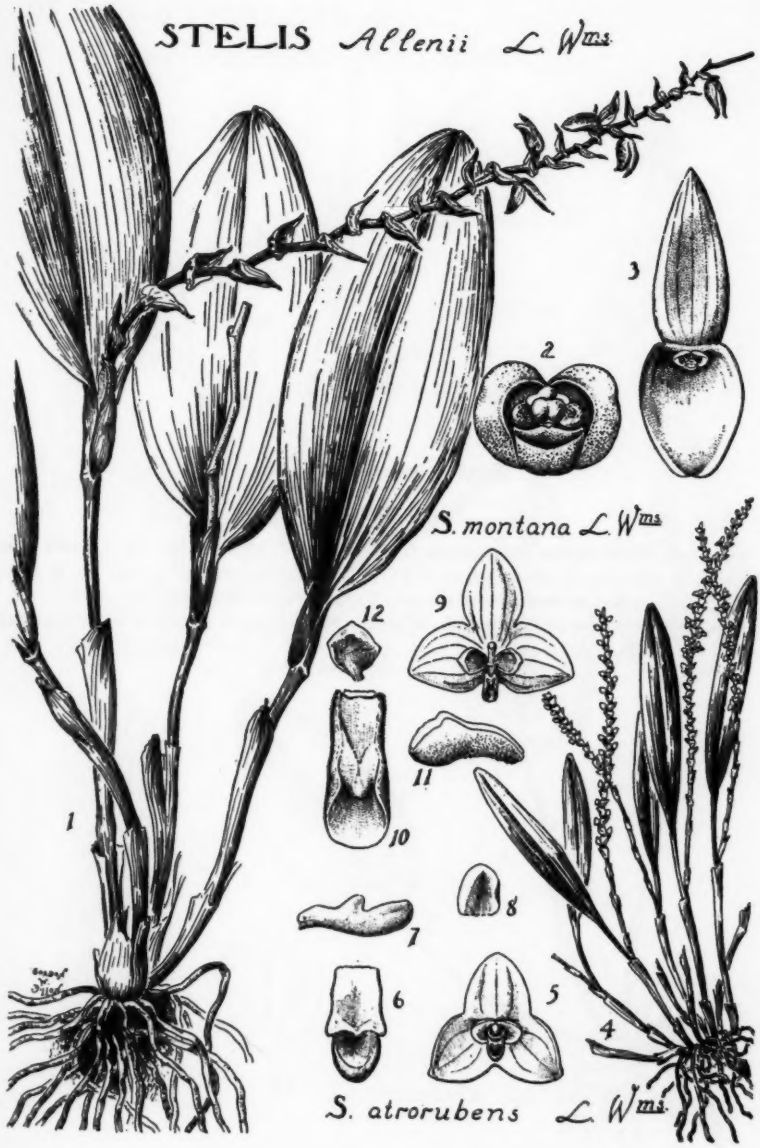
EXPLANATION OF PLATE

PLATE 32

Figs. 1–3. *Stelis Allenii* L. Wms.: fig. 1, plant, × ½; fig. 2, column, petals and lip seen from the front, × 8; fig. 3, flower expanded, × 2.

Figs. 4–8. *Stelis atrorubens* L. Wms.: fig. 4, plant, × ½; fig. 5, flower expanded, × 5; fig. 6, lip from above, × 10; fig. 7, lip from side, × 10; fig. 8, petal, × 10.

Figs. 9–12. *Stelis montana* L. Wms.: fig. 9, flower expanded, × 2½; fig. 10, lip from above, × 10; fig. 11, lip from the side, × 7½; fig. 12, petal, × 5.



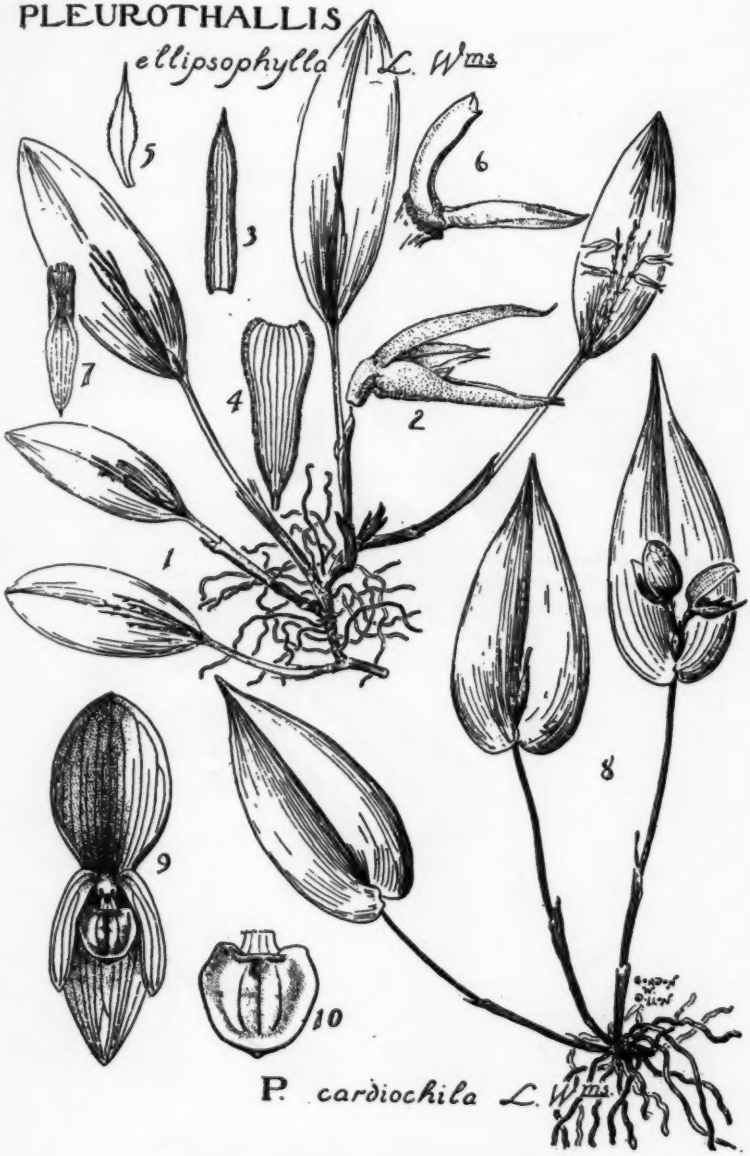
WOODSON & SCHERY—FLORA OF PANAMA

EXPLANATION OF PLATE

PLATE 33

Figs. 1–7. *Pleurothallis ellipsophylla* L. Wms.: fig. 1, plant, × ½; fig. 2, flower from the side, × 2½; fig. 3, dorsal sepal, × 2½; fig. 4, lateral sepals, × 2½; fig. 5, petal, × 2½; fig. 6, lip and column from the side, × 5; fig. 7, lip from above, × 5.

Figs. 8–10. *Pleurothallis cardiochila* L. Wms.: fig. 8, plant, × ½; fig. 9, flower expanded × 1½; fig. 10, lip, × 3.

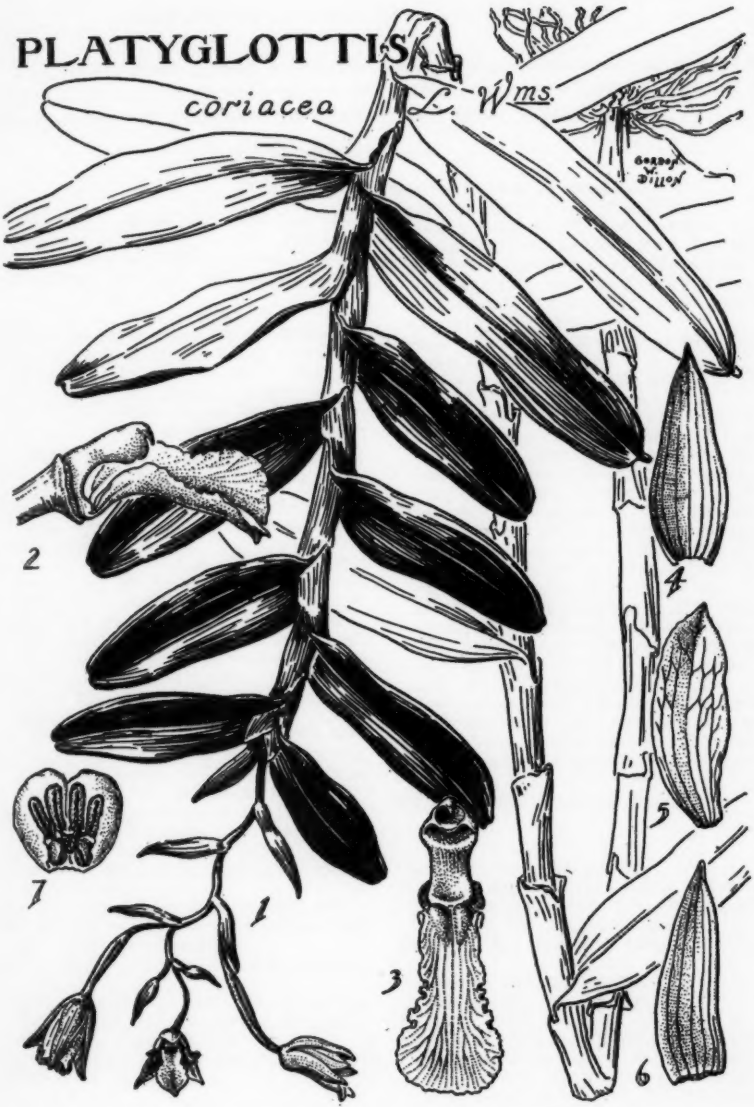


WOODSON & SCHERY—FLORA OF PANAMA

EXPLANATION OF PLATE

PLATE 34

Platyglottis coriacea L. Wms.: fig. 1, plant, × 1; fig. 2, column and lip from the side, × 3; fig. 3, column from front with the lip bent down, × 3; fig. 4, dorsal sepal, × 3; fig. 5, petal, × 3; fig. 6, lateral sepal, × 3; fig. 7, anther from below, × 10.



WOODSON & SCHERY—FLORA OF PANAMA

GENERAL INDEX TO VOLUME XXIX

New scientific names of plants and the final members of new combinations are printed in **bold-face** type; synonyms and page numbers having reference to figures and plates, in *italics;* and previously published names and all other matter, in ordinary type.